TECHNOLOGY DEPT.

Gas Journal

Vol. 263. 102nd Year. LONDON, JULY 5, 1950. No. 4544. Price 1/-

Registered as a Newspaper.

PUBLIC LIBRARY
JUL 22 1950
DETROIT

Venture, Vision, Versatility

"The Venture and, if I may say so, the vision are long-term." The sentence is from our Chairman's Address at the Twenty-First Annual General Meeting of Shareholders. His reference was to the expansion of Bell's in Southern Rhodesia from Gwelo as headquarters. We of Bell's are proud, he said, to be "among the pioneers in British territory of real promise and potentiality." But the alliteration, natural and unforced, "venture . . . vision," lingers in the memory. Later the Chairman, Mr. Claude W. Bell, used the word "versatility" : "There is a versatility about Asbestos which never seems to fail us . . . our research is alert and constant and is ever straining at the leash." The Three V's, Venture, Vision, Versatility, express much of a philosophy we strive to translate into action. Perhaps Vision comes first; we keep the eyes of the mind open not only to opportunity but also to the possibility of turning an engineering problem and difficulty into opportunity. As to Venture, Bell's has been built by a boldness of considered development. Versatility is in Asbestos itself and seems to summon us to a resiliency of method and approach to tasks engineers set us who are eager to rejuvenate their plants to make their sections of industry more efficient in markets where buyers and not sellers tend to become dominant

The Salamander lively and unscathed in the heart of flame is the symbol of Asbestos

BELL'S ASBESTOS AND ENGINEERING LIMITED

SLOUGH *('phone 20211)* **BUCKS**

25 Branches (including 12 in the Dominions)

JR v.263 July-Sept. 1950

NO JOB IS TOO SMALL for OXLEY ENGINEERING CO. LTD.

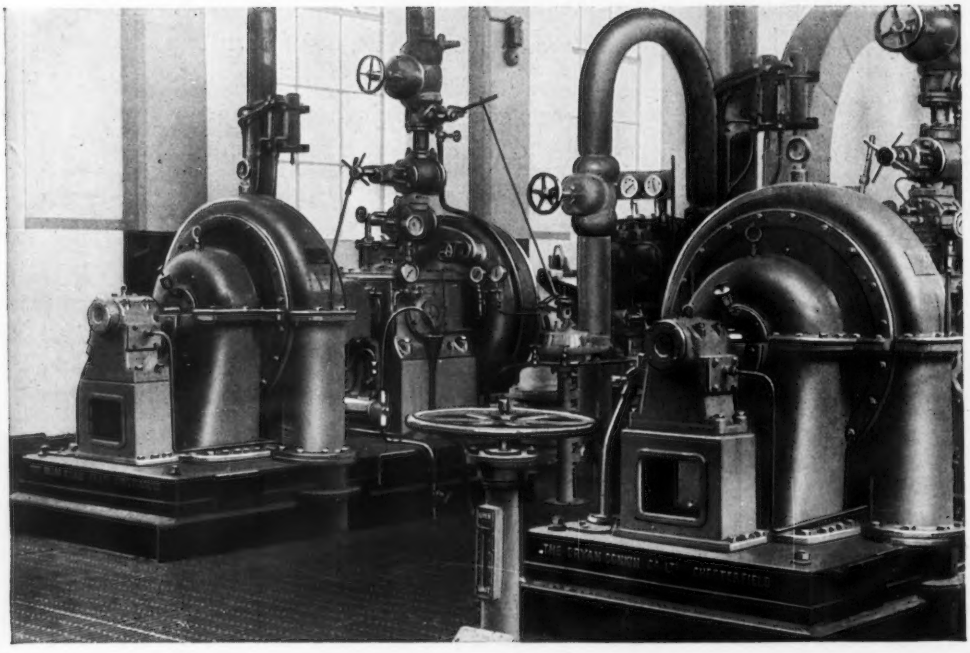
The small gasholder illustrated exemplifies OXLEY versatility in tackling such work for special purposes. At the other end of the scale the same accuracy and attention to detail is shown in constructing huge all-welded gasholders of 3 million cu. ft. capacity. Between these extremes OXLEY offer a highly-specialised service in gasholder design, manufacture and construction—a fact which gas undertakings everywhere have realised to their benefit.

-AND NONE TOO LARGE!

OXLEY ENGINEERING CO. LTD., HUNSLET, LEEDS 10

Telephone: LEEDS 32521
Telegrams: OXBROS, LEEDS 10

London Office: WINCHESTER HOUSE, OLD BROAD STREET, E.C. 2
Telephone: London Wall 3731 *Telegrams:* Asbengpro, Stock, London
(R) W108



RATEAU TURBO GAS EXHAUSTERS AND BOOSTERS

Fig. 948

Two 900 m/m. Rateau Turbo Boosters each to pass 850,000 cubic feet of gas per hour against 30" W.C. presssure difference running at 3,650 r.p.m. driven by 115 B.H.P. Brotherhood Steam Turbine

THE BRYAN DONKIN CO. LTD.

CHESTERFIELD

Tech.

Metolite
REGD.
LIGHTER FLINTS

FOR
AUTOMATIC IGNITION
OF
DOMESTIC COOKERS
GAS REFRIGERATORS
FIRES ETC

SUPPLIES OF ALL TYPES NOW AVAILABLE
TO PUBLIC UTILITIES

ESTD. 1928
THE BRITISH FLINT & CERIUM MANUFACTURERS LTD
TONBRIDGE · KENT
(CONTRACTORS TO H.M. GOVERNMENT)
TELEPHONES:
TONBRIDGE 2753 & 2970
TELEGRAMS:
"BRITFLINT" TONBRIDGE

GEORGE
GLOVERS

George Glover & Co. Ltd
*
LONDON
Cardiff * Leeds
Warrington * Manchester

GAS
METERS

Dependable
Year-in
Year-out

GAS
METERS

Product of Radiation Ltd

Ether-Wheelco "Capacitrol" E.W.221.

This instrument utilises electronic action to achieve rapid and accurate control of furnace temperature. Supplied for On, Off, High, Low and Proportional Control.

Ether "Indicorder" Type C.R.M.S.

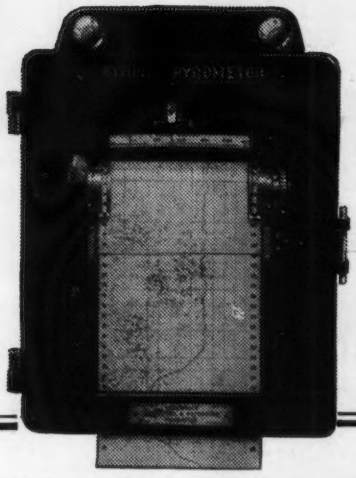
Indicate, Record and Control Gas Furnace Temperatures automatically. Made for Wall or Panel Mounting. Send for List No. 645.

ETHER

AUTOMATIC

TEMPERATURE CONTROLLERS

Mechanically and Electronically Operated



Pass your automatic temperature problems to us — We design and manufacture a full range of Instruments and Valves and can advise the most suitable apparatus to meet your requirements.

We also manufacture, under the American Wheelco Co. Patents, a range of Ether-Wheelco Electronic Controls which, when supplemented by our normal Ether range of Instruments, cover every Automatic Temperature Control requirement.

Our technical advisory service is always at your service.

ETHER LIMITED
TYBURN ROAD, ERDINGTON,
BIRMINGHAM, 24.
Telephone - - EASt 0276-0277

C4

CARRON GAS-HEATED PASTRY OVEN

Interior of cast-iron and sheet-steel; exterior vitreous enamelled • Drop doors, fitted with heat-resisting packing, form airtight joint against front • Insulated oven door handles • Pilot jet fitted to each burner • Packed throughout with thermal insulation. Write for full details and prices.

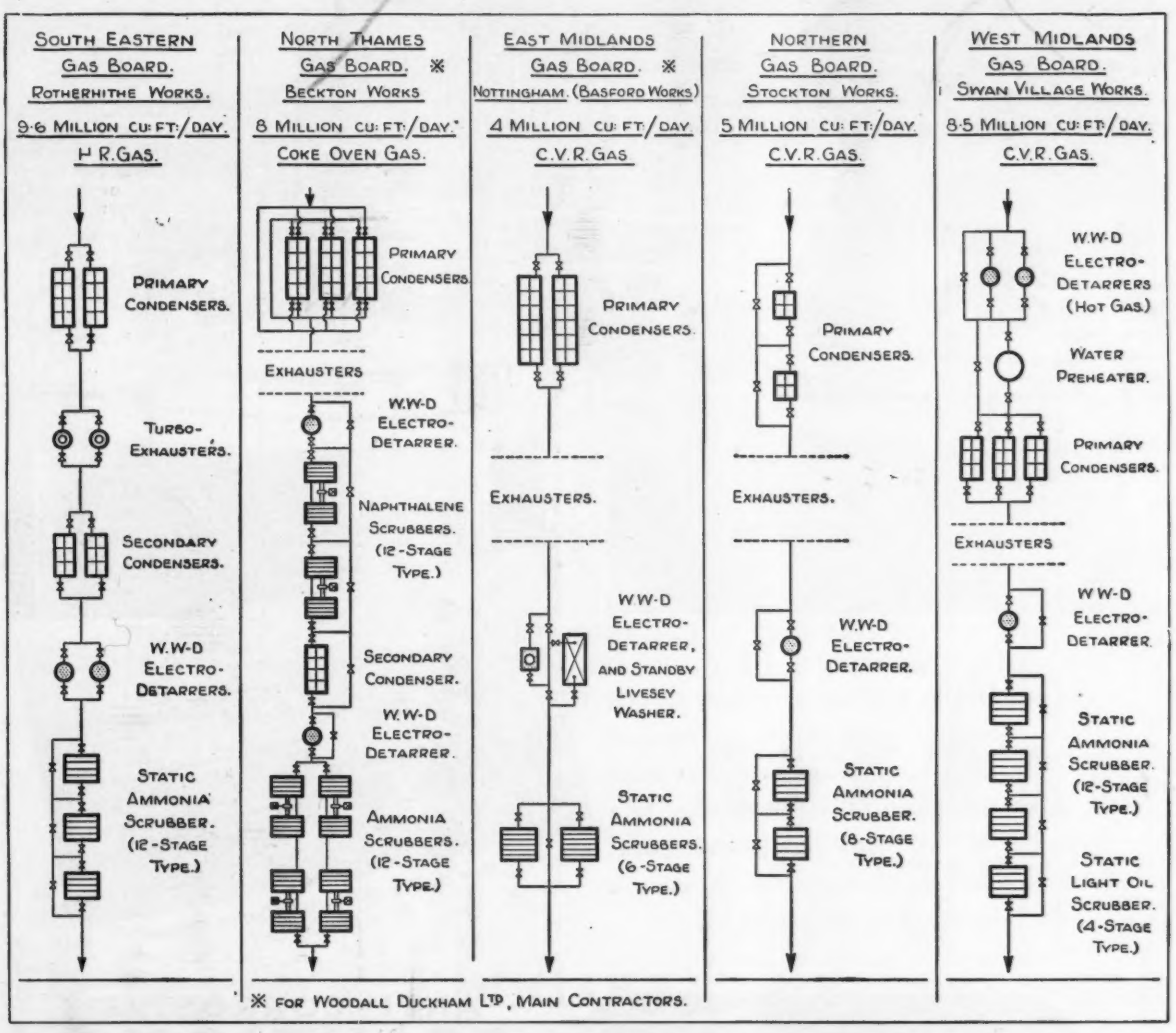
CARRON

This is a Carron product made by modern Carron processes embodying the Carron tradition for fine workmanship begun in 1759

CARRON COMPANY · CARRON · FALKIRK · SCOTLAND • 15 *Upper Thames St., London, E.C.4* · 22-26 *Redcross St., Liverpool, 1* • 125 *Buchanan Street, Glasgow, C.1* · 14 *Ridgefield, Manchester, 2*

Esto Perpetua

MODERN WET PURIFICATION PLANT *by* WHESSOE



※ FOR WOODALL DUCKHAM LTD., MAIN CONTRACTORS.

DESIGNERS AND CONTRACTORS FOR COMPLETE PLANT

WHESSOE LIMITED, DARLINGTON Telephone: Darlington 5315

LONDON - 25 VICTORIA ST. S.W.1 Telephone: Abbey 3881

DON'T WAIT TILL *CORROSION* SETS IN

Unprotected iron and steelwork rapidly deteriorate when exposed to industrial fumes, gases etc. Thorough maintenance checks at regular intervals followed if necessary by a coating of "BITUMASTIC" Solution, Enamel or one or other of Wailes Dove products, is the finest safeguard against corrosion

View showing rack on our exposure station for weathering tests.

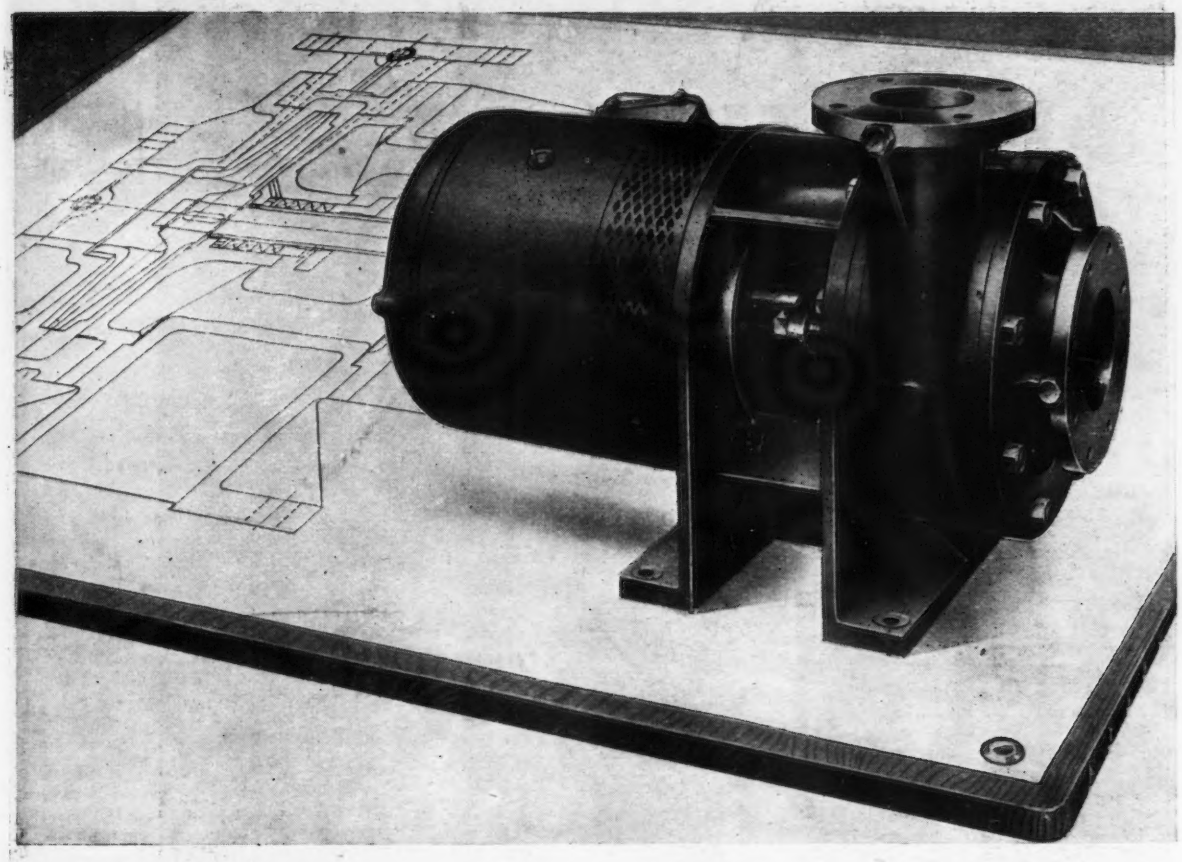
"BITUMASTIC"

ANTI CORROSIVE SOLUTIONS

IN BLACK AND COLOURS

WAILES DOVE BITUMASTIC LTD • HEBBURN • Co. DURHAM.

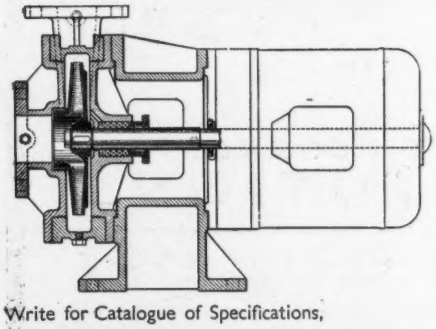
Area Offices and Stores situated in all principal towns. Agents throughout the World. 9H 37



Never was Design

more practically evolved, more thoroughly produced or more convincingly proven by performance than in this UNISHAFT

SAFRAN
REGISTERED TRADE MARK
CENTRIFUGAL PUMP

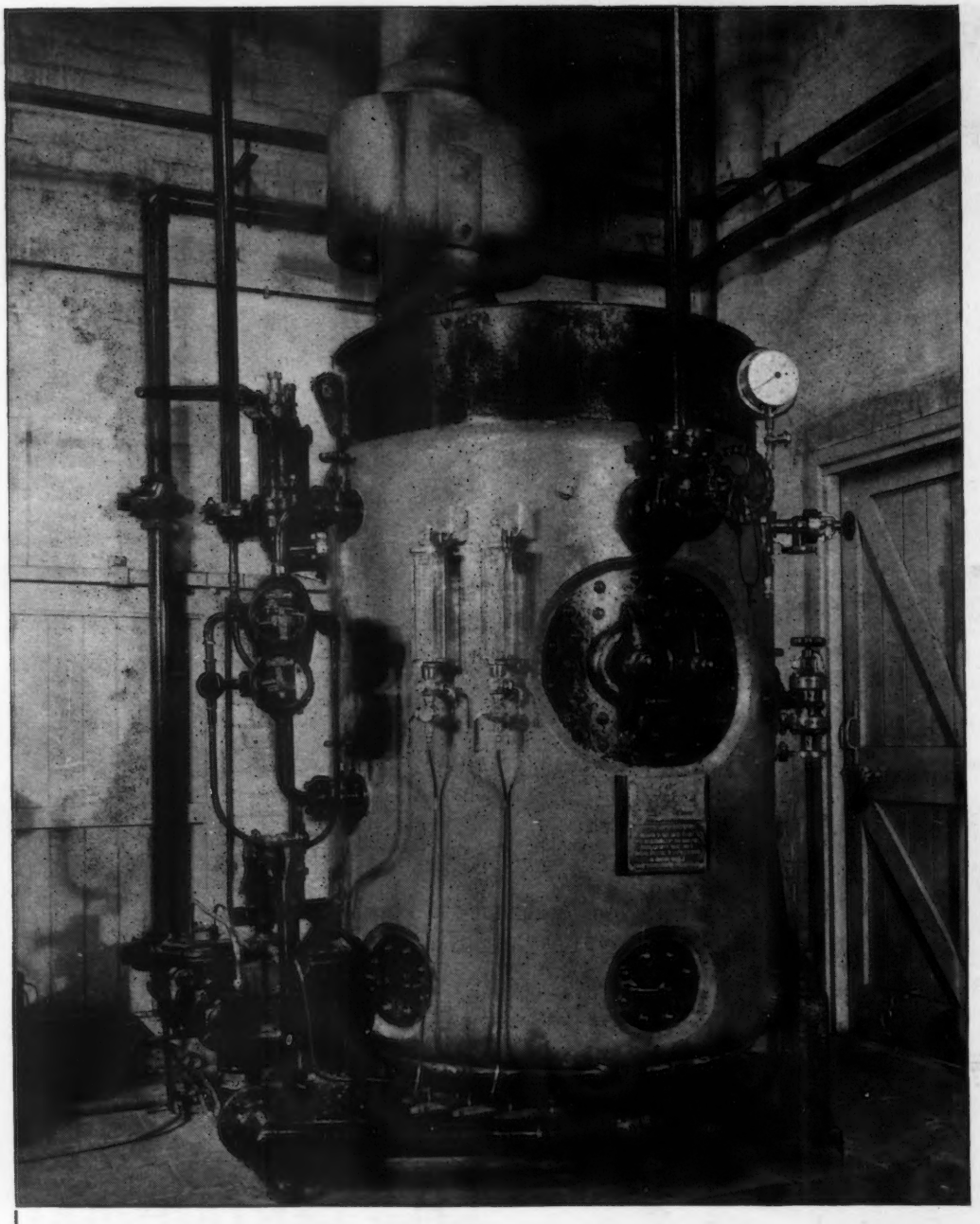


Write for Catalogue of Specifications, Illustrations and Performance Tables.

UNISHAFT IS STRENGTH
compactness, smooth-running and efficiency in pumping

The complete SAFRAN range comprises 8 types of drive.
8 Sizes from ¾"/1" to 5"/6".
Electric Motor, Petrol and Diesel Engine drive.
Duties to 60,000 G.P.H. or 173 Feet Head

SAUNDERS VALVE Co. Ltd., CWMBRAN, MONMOUTHSHIRE, ENGLAND



ANOTHER BAKERY

A 4′ 0″ diam. 7′ 0″ high Cochran 'Sinuflo' Gas Fired Boiler, pressure 125 lbs. per sq. in., at Newbould's Automatic Bakeries, Bradford.

We are accepted by LLOYDS for Class 1 welding of Pressure Vessels

COCHRAN

Cochran & Co., Annan, Ltd., Annan, Scotland, and at 34 Victoria Street, London, S.W.1.

TAS/CH. 400

"ABBIRKO" FORCE PUMPS

For Clearing Gas Service Pipes

No. 77 MODEL

PUMPS OF QUALITY:

EFFICIENCY GUARANTEED

. . . . . .

WE MAKE TWO MODELS VIZ.,

NO. 77 : *FITTED WITH FULLWAY COCK SINGLE STAGE PUMP, DESIGNED FOR GENERAL UTILITY WORK.*

. . . . . .

NO. 35 B : *IMPROVED HIGH PRESSURE FORCE PUMP FITTED WITH TWO STAGE PUMP, INSTANTANEOUS PISTON RELEASE COCK, 300 lbs. PRESSURE GAUGE.*

MULTIPLE SCREWED ADAPTOR CAN BE SUPPLIED WITH EITHER PATTERN.

TRADE ABBIRKO MARK

No. 35B MODEL

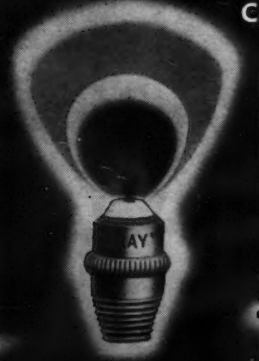
Write for particulars to Sole Makers :

ABBOTT, BIRKS & CO. LTD.

'Phone Waterloo 4066 (4 lines). 90-91 Blackfriars Road, LONDON, S.E.1. 'Grams : "Abbirko, Sedist, London"

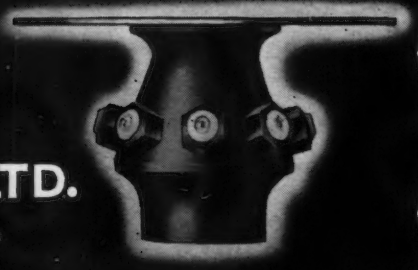
Bray Burners

FLAT FLAME NON-ATMOSPHERIC



are used in ~

Cookers, Portable Boiling Rings, Water Heaters, Fires, Radiators, Canteen Equipment, Boilers, Overhead Radiant Heaters, Infra-Red Drying Units, Furnaces etc.



Please send enquiries to

GEO. BRAY & CO., LTD.

LEICESTER PLACE,

LEEDS·2

RECONDITIONING
DAMAGED AND DEFECTIVE CONCRETE STRUCTURES

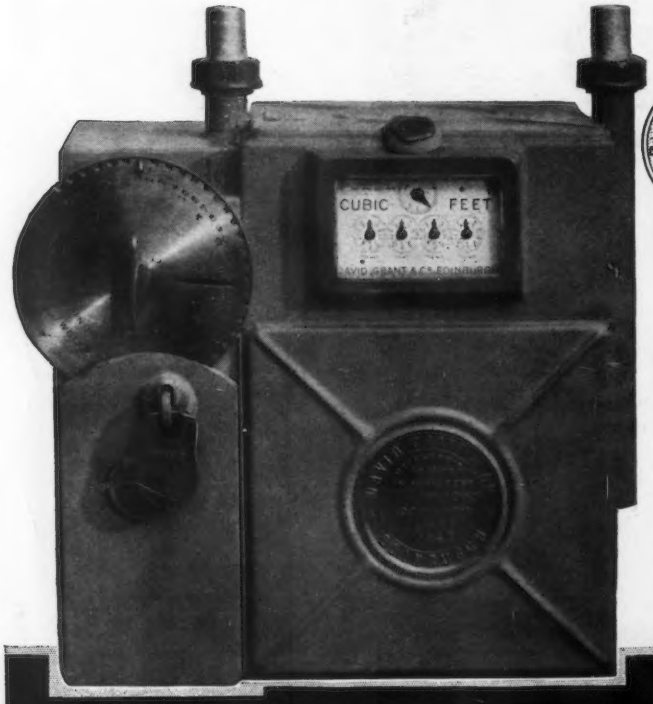
ENCASING
STRUCTURAL STEELWORK

COVERING
THE WEARING SURFACES OF SHUTES AND BUNKERS

LINING
TUNNELS, RESERVOIRS, CULVERTS

THE CEMENTATION CO. LTD.
BENTLEY WORKS, DONCASTER.

ENQUIRIES, PLEASE, TO :
39, VICTORIA ST., LONDON, S.W.1 Abbey 5726-7-8



PREPAYMENT *Meters*

Since David Grant & Co. Ltd., introduced one of the first pre-payment meters early in their career, their record has been one of steady progress. In 1895 David Grant were already offering pre-payment meters with Optional Coin facilities. Today, with their wide range of pre-payment and ordinary meters, gauges and pumps, they still maintain that progressive policy which has made their name synonymous with service and satisfaction.

David Grant,
100 cu. ft.
Optional Coin Meter

DAVID GRANT & CO., LTD., PHONE EDINBURGH 41574
EAST CROSSCAUSEWAY, EDINBURGH, 8. AND AT MANCHESTER.

DAVID GRANT & CO
1855
PIONEERS IN PREPAYMENT METERS
1950
EDINBURGH

ELECTROLUX REFRIGERATORS
excel in being *Silent at all times* . . .
excel in dependable performance . . .
excel in low maintenance cost—
because there is no machinery or other moving part to wear out or cause irritating noise.

Electrolux *Excels* . . .

By Appointment Refrigerator Makers

. . . as the originator of the only absorption system which has proved suitable for domestic refrigerators. Electrolux Gas Refrigerators are backed by the research and experience of a quarter of a century.

By Appointment Suction Cleaner and Refrigerator Manufacturers

ELECTROLUX LIMITED, 153/5, REGENT STREET, LONDON, W.1. WORKS: LUTON, BEDFORDSHIRE

royds

KLEENOFF
The cooker cleaner that is asked for

KLEENOFF is a repeat selling line you can recommend with confidence

Supplied in bulk, for use in stove shops

The specially designed Kleenoff *brush is again available*

THE KLEENOFF CO.,

(Proprietors: Bale & Church Ltd.)

33, ST. MARY-at-HILL, LONDON, E.C.3

Telephone: Mansion House 1156.

50ft. MAMMOTH STACKER IS HANDLED BY ONE MAN — THE MOBILE SHOVEL DRIVER

A Mammoth has been towed 200 miles in 12 hours . . . proof of its road worthiness.

The CT Mammoth Stacker illustrated can shift 80 tons of coal per hour, has a large feed hopper which facilitates tipping for mechanical shovels, or grabs, is designed and constructed to withstand years of hard usage. Mammoth Stackers are made in two standard sizes 40ft. and 50ft., available with diesel or electric drives. We welcome the opportunity to help solve your stacking problems.

CRONE & TAYLOR LTD

SUTTON OAK, ST. HELENS LANCS

ORDER NOW FOR SUMMER DELIVERY

CRO/1425 S-T

Art and Craft

The designer's Art and skilful Craft produce works of quality in any period.

Amphora by the potter Execias
6th century B.C.

"Newhome"

MODERN GAS COOKERS

Finished in 'Superl' enamel

STOVES LIMITED, RAINHILL, LIVERPOOL

Telephone: Prescot 6255/6

LONDON SALES OFFICE: 91 FARRINGDON ROAD, E.C.1. Telephone: Holborn 7654

89-455

HIGH GRADE SLOT AND ORDINARY METERS

I.G.E. AND HIGH CAPACITY LISTS

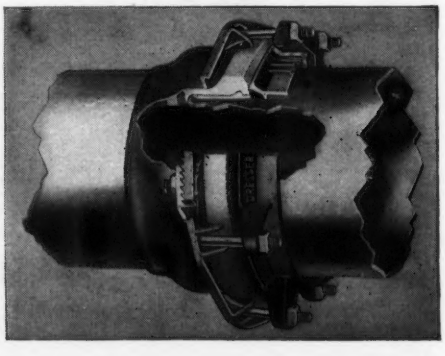
Nothing but the best materials and workmanship used in their manufacture

R. LAIDLAW & SON (Edin.) Ltd.
SIMON SQUARE WORKS, EDINBURGH
8/9, LUDGATE SQUARE, LONDON, E.C.4

Repairs—Parts Supplied

DRESSER CLAMPS

Give a better joint



- Balanced construction throughout.
- Easily fitted by unskilled labour.
- Eliminate repeated recaulking.
- Absorb vibration, expansion and contraction.
- Anchor and follower rings adjustable.
- Gasket specially designed to ensure tightest joint.
- Malleable iron castings high-strength metal.

Supplied in all sizes from 3 in. to 48 in. diameter.
Illustrated leaflet and assembly instructions on request.

Face of socket and pipe thoroughly cleaned

Anchor ring assembled and gasket painted with soap-water

Gasket in position and follower ring being assembled

Final firm tightening of bolts and nuts

Sole Distributors to the Gas Industry:

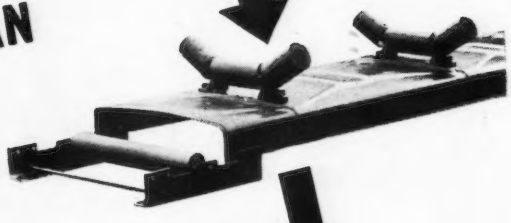
HEWITT CONSTRUCTION LTD.
39 VICTORIA STREET · LONDON · S.W.1.
Telephone: Abbey 5238 *Telegrams: Kinhilco Sowest London.*

British Manufacturers:

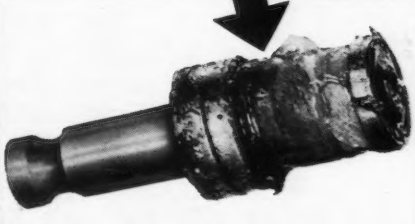
CONSOLIDATED PNEUMATIC TOOL CO. LTD.
232 DAWES ROAD, LONDON, S.W.6.

CONVEYORS!

YOU CAN'T DO BETTER THAN FIT M&C IDLER ROLLERS



Most of the well-known conveyor makers buy their idler rollers from M&C. They value the supremely easy running, and the way the efficiency continues high. They know that friction-free labyrinth seals keep the ball bearings clean, and proof against attack even by penetrating dust. They have found the idlers have a long life — sometimes twenty years — preserve the belts, and reduce conveying costs. These conveyor specialists show by their example that it pays to use M&C idlers. *Booklet E.59 is yours for the asking.*



For permanent or temporary conveyors, in gantries, out of doors or inside factories, M&C sectional belt conveyors simplify maintenance. The spindle, shown withdrawn from its idler roller after long service, still has plenty of soft clean grease around the bearings.

MAVOR & COULSON LTD

BRIDGETON, GLASGOW, S.E. OLIVE GROVE ROAD, SHEFFIELD, 2 36 VICTORIA STREET, LONDON, S.W.1

Nothing to be seen? . . . No sign of a pump or pump-house? . . . And the tank filling at the rate of 40,000 gallons an hour? . . . There must be a Sumo somewhere.

Very often a square of chequer-plate, flush with the ground, is the only sign of a borehole in which a Sumo pump is working, for a Sumo unit — a pump and motor built together in permanent alignment—is suspended by its delivery main and completely immersed in the well. A.C. power goes down to it through a tough rubber cable.

Installation is no more trouble than lowering the delivery main of any other type of pump. There are no bearings to align — or to give trouble later. Once installed, a Sumo will run for years without attention. The overall efficiency is high, so that running costs are low.

There are Sumo pumps for boreholes from 6 in. diameter upwards, and for deliveries of 200 to 80,000 gallons an hour: they are used for such various duties as raising water for homes, farms, factories and major irrigation schemes; for de-watering mines and waterlogged ground. Sumo Pumps are manufactured in England by . . .

SUMO PUMPS LTD

(A SUBSIDIARY OF CHANCE BROTHERS LTD.)

DEPT. S.7, LIGHTHOUSE WORKS, SMETHWICK 40, BIRMINGHAM

Phone: **West Bromwich 1051**

'Sumo' is the registered trade mark of Sumo Pumps Ltd.

A Chance PRODUCT

NOW IT CAN BE TOLD!

Ever since the first of these advertisements reached the public, there's been no end to enquiries and sales... proving the enormous popularity of this little cooker that brings to 1, 2, and 3-room homes a complete cooking service.

Over 14,000,000 circulation for Junior General advertising — in Radio Times, London and leading provincial papers! And here are some of the attractive, successful advertisements!

GAS RING CRIME...
Gas ring meals are a crime! No wonder thousands are throwing out their gas rings now.
HOORAY! NO MORE GAS RING COOKING!
WHAT'S GOING ON HERE?
LOOK! THIS COOKS A WHOLE 3-COURSE MEAL!
At last, a cooker that boils, grills, bakes, roasts, does everything!
WISH I COULD STAY!
They have full-size meals every day now!
IT'S A BEAUTY- BUT CHEAP!
The Junior General Gas Cooker is designed specially for people living in small quarters. Quick-heating oven. Grill (or another burner). Black and cream enamel finish. Burner for boiling.
BIG MEALS NOW IN SMALL QUARTERS — WITH THE
JUNIOR GENERAL GAS C
Call at your local Gas showrooms or wri
GENERAL GAS APPLIANCES LIMITED, Corporation
GAS RING COOKS....
How to be happier in small quarters!
Now they can enjoy real cooking— and to celebrate (for who can cook a roast on a gas ring) friends come to dine on roast beef....
thousands of r the secret comfort in
They now have a Junior General', the gas cook- er designed specially for where space is scarce'. Quick heating, two-shelf oven. Burner for boil- ing. Full-size grill (or another boiling burner). Drop-down oven door for handy shelf. Black and cream enamel finish.
PLIANCES LTD haw, Manchester
RAL GAS
GOODBYE GAS RING!
Here's news for those who live in small quarters! No more gas ring cooking! No more queues of pots and pans waiting their turn!
Thousands are throwing out their gas rings. For at last, here's a cooker—with hot-plates, grill, oven! It roasts, boils, bakes, does everything!
1st COURSE
2nd COURSE
3rd COURSE
Three-course meals every day! Guests entertained! Social life flourishing! Now, even in a "bed-sit", life is happy!
FOR WHAT YOU SPEND ON ODD MEALS OUT you can buy this wonder- ful cooker. Designed for complete cook- ing service. Quick-heating oven. Burner for boiling. Grill (or another burner). Black and cream enamel finish.
A Product of Allied Ironfounders Ltd.
REAL MEALS NOW IN SMALL QUARTERS with the
JUNIOR GENERAL GAS COOKER
Call at your local Gas showroom or write for a leaflet to:
GENERAL GAS APPLIANCES LTD., Corporation Road, Audenshaw, Manchester

Advertising continues and your orders can be promptly filled

ALL NAMES AND ADDRESSES of enquirers have been passed along to Gas Undertakings, and this sales co-operation will continue as the advertising goes on. Our production has been built up to meet the enormous demand and we can despatch to you promptly. Don't delay showing and selling the Junior General Gas Cooker — sturdily built; finished in black and cream enamel; with 1 boiling burner and griller (or 2 boiling burners); measuring 20¾" wide, 12⅝" high, 12⅝" deep. *Get in touch with us today.*

GENERAL GAS APPLIANCES LIMITED
CORPORATION ROAD, AUDENSHAW, MANCHESTER

(Proprietors: Allied Ironfounders Ltd.)

AI TRADE MARK

ELEVATORS

- BELT & BUCKET
- CHAIN & BUCKET
- SWING TRAY
- BARREL
- PORTABLE
- ETC.

CONVEYORS

- APRON
- BAND
- DRAG LINK
- GRASSHOPPER
- PUSHPLATE
- SLAT
- SPIRAL
- TRAY
- ETC.

MARCO

CONVEYOR & ENGINEERING CO. LTD.

We are designers and manufacturers of all types of HANDLING EQUIPMENT, CONVEYORS, ELEVATORS, SCREENS and BUNKERS. Also all types of COAL AND ASH HANDLING PLANTS.

Our Technical Department is at your service if you are interested in labour-saving devices and in speeding production.

Catalogue free on application.

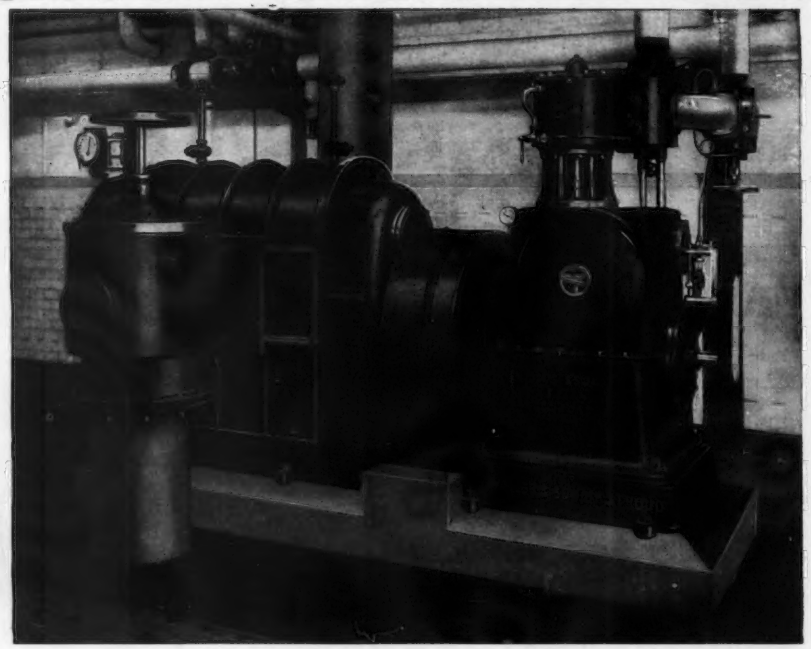
ROWIN WORKS, LYNN ROAD, LEYTONSTONE, LONDON, E.11
Tel.: LEYTONSTONE 2254/5. Grams.: ENGIMARCO, EASPHONE.
Midland Office—3 Bond St., Hockley, Birmingham 19. Tel.: CENTRAL 2917

Represented in
SOUTH AFRICA · ISRAEL
BRITISH WEST INDIES
FRANCE · BELGIUM
CHINA · SOUTH AMERICA

For efficient and economical handling, it pays to consult **MARCO**

SISSON STEAM ENGINES

DESIGNED for driving EXHAUSTERS BOOSTERS COMPRESSORS ETC.



DEPENDABLE for NON-STOP DUTY

SUITABLE for GAS GOVERNOR or AUTOMATIC CONTROL

SISSON ENGINE DRIVING WALLER-ROOTS EXHAUSTER (By courtesy of Messrs. G. Waller & Son, Ltd.)

Telegrams:— SISSON. **W. SISSON & CO LTD., Gloucester, Eng.** Telephones:— 22295-6.

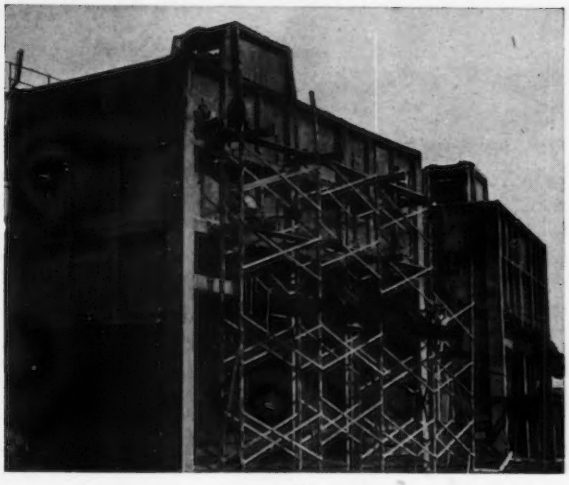
Harvey

ALUMINIUM LOCKERS

In view of the present restricted supplies of Steel Sheet these well-known Harvey Lockers are now fabricated of Aluminium Alloy Sheet, but to maintain their strength, retain their Steel Legs and Posts. Made in units of three lockers, in three styles, one-door, two-door and four-door they are all 6 ft. high by 1 ft. square with exterior stoved Olive Green Enamel.

G. A. Harvey & Co. (London) Ltd.
Woolwich Road, London, S.E.7

Gunite



One of the reinforced concrete structures reconditioned with Gunite for the City of Carlisle Gas Undertaking.

Gunite—concrete applied by air pressure has numerous applications where its great density and extreme adhesion have exceptional value.

For repairing reinforced concrete It has particular merit, as, due to the method of application, a uniform density and adherence is obtained whenever Gunite is applied.

For lining coal bunkers and steel chimneys it possesses great resistance to corrosion and protects steel-work from the abrasive action of coal or coke

Handbook "GUNITE" sent on request.

THE CONCRETE PROOFING CO., LTD.

100, VICTORIA STREET, S.W.1

Telephone: Victoria 7877 & 6275

DETROIT PUBLIC LIBRARY

Discharge end of new Gibbons-Dressler Tunnel Kiln, showing firebrick shapes being off-loaded to conveyor.

Background to a Quality Production

Behind the up-to-date methods of manufacture by which Gibbons Refractories are made lie a hundred years of experience and research at the Gibbons works in the development of furnace linings of the highest heat-resisting qualities.

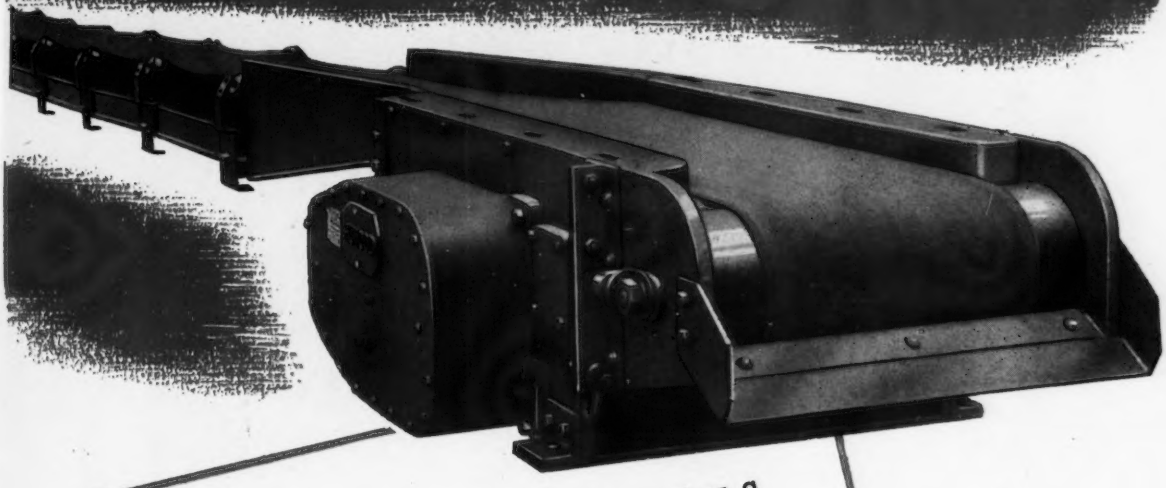
H.T.1. · ALUMINOUS · SILICA · FIREBRICK · SILLIMANITE

GIBBONS superior refractories

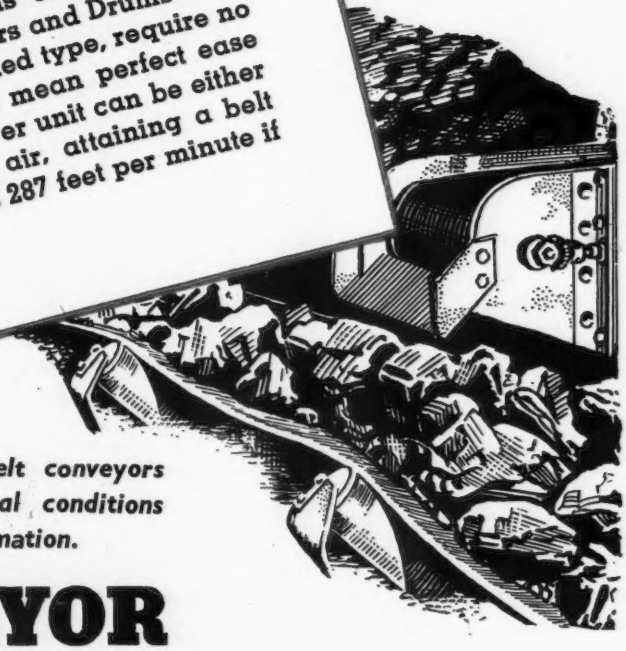
Gibbons (Dudley) Ltd., Dibdale Works, Dudley, Worcs.

H W.20

LIGHT-WEIGHT CONVEYOR ...WITH CRUISER CAPACITY!



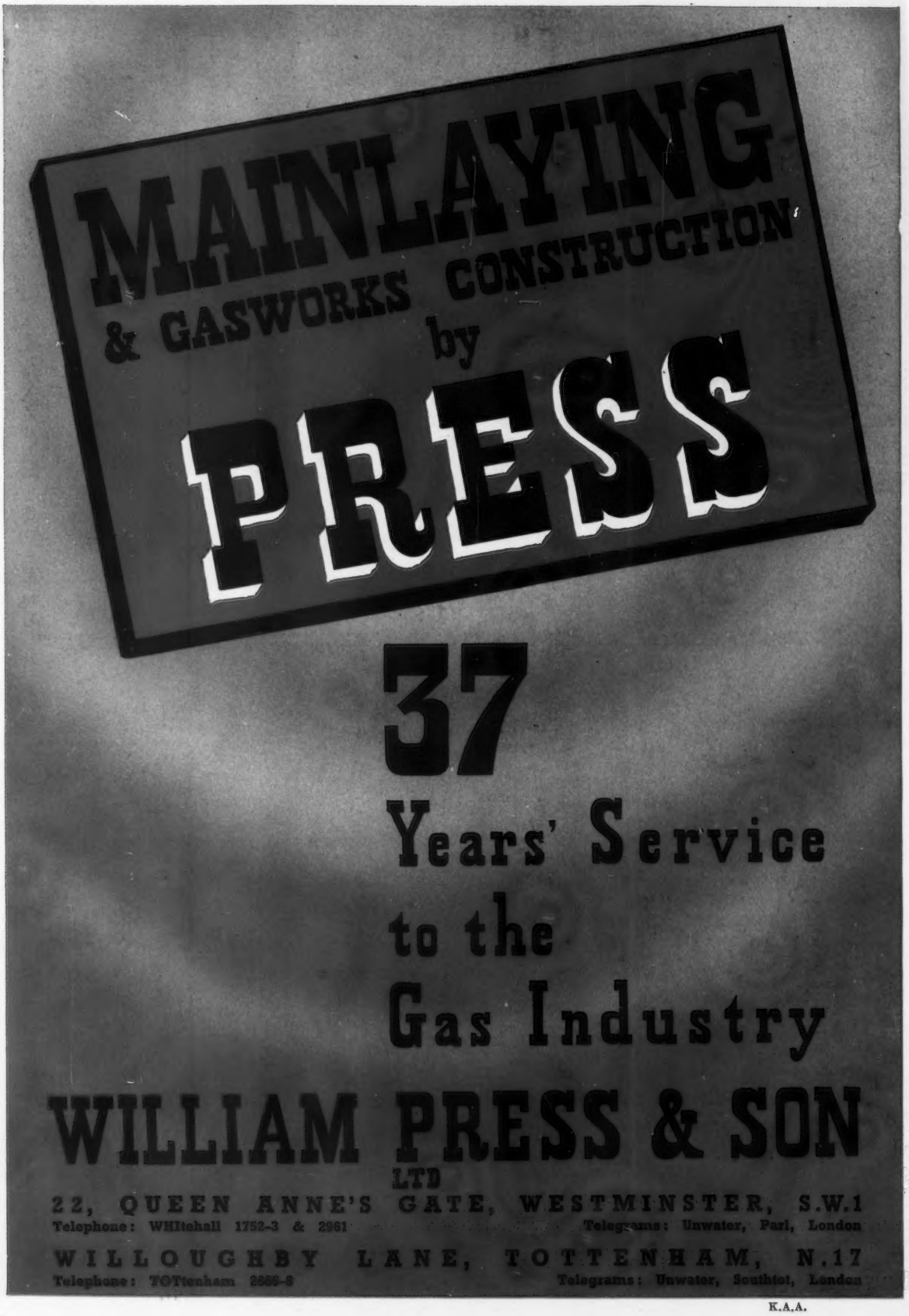
This light and powerful conveyor has a capacity out of all proportion to its weight, making it ideal for thin seams. It is available in the belt widths of 20", 24", and 26". All the Idler Rollers and Drums used are of the patent oil-filled type, require no other lubrication and mean perfect ease in running. The power unit can be either A.C. or compressed air, attaining a belt speed of as high as 287 feet per minute if required.



★ *Huwood make top and bottom belt conveyors of many types to suit the individual conditions of all mines. Write for full information.*

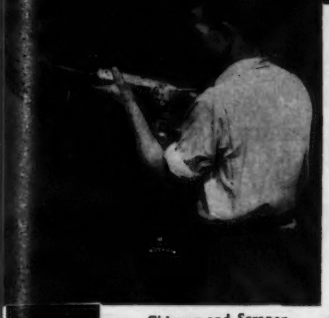
T.B'15 CONVEYOR

HUGH WOOD & CO. LTD., Dashwood House, 69, Old Broad St., London, E.C.2. Factories: GATESHEAD-ON-TYNE, 11.


MAINLAYING
& GASWORKS CONSTRUCTION
by
PRESS
37
Years' Service
to the
Gas Industry
WILLIAM PRESS & SON
LTD
22, QUEEN ANNE'S GATE, WESTMINSTER, S.W.1
Telephone: WHitehall 1752-3 & 2961
Telegrams: Unwater, Parl, London
WILLOUGHBY LANE, TOTTENHAM, N.17
Telephone: TOTtenham 2866-8
Telegrams: Unwater, Southtot, London

K.A.A.

MECHANICAL CLEANING OF STEELWORK



Chipper and Scraper

Rotary Wire Brush

INDUSTRIAL PAINTING CONTRACTORS

De-Scaling, Cleaning and Painting of Structural Steelwork and Industrial Plants, Flame De-Scaling,

ETC.

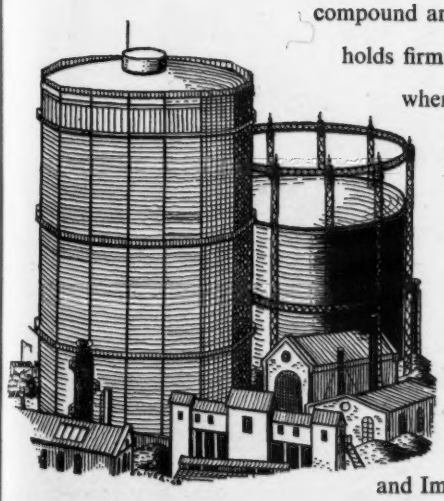
THE ELECTRO-DEPOSITING Co LTD

Contractors to H.M. Government

STANDARD WORKS - CHERRY STREET - WOLVERHAMPTON

TELEPHONE: 21275-6

RUSTY ANSWER



Rustodian is a new answer to rust. This primer is based on a new lead compound and has been developed and tested over a number of years. Its tough film holds firm under all conditions and actively inhibits the formation of rust. Even when it is exposed to salt water or submerged under the sea Rustodian shows a remarkably strong resistance to blistering. The film, of course, may be broken or scarred, for accidents will happen, but Rustodian actively inhibits rust and protects bare iron *even after* the film has been scratched. Its life is as long or even longer than Red Lead and under continual salt water test conditions Rustodian has shown a life of 90/112 days compared with a life of 10/14 days of other standard rust inhibitors tested. Rustodian is available in Light Stone and B.S.S. colours Light Brunswick Green, Dark Battleship Grey and Imperial Brown. We shall be pleased to send you full details if you write to

AN ASSOCIATED LEAD PRODUCT

ASSOCIATED LEAD MANUFACTURERS LIMITED

Ibex House, Minories, E C 3 **London**

Crescent House **Newcastle**

Lead Works Lane **Chester**

TUBELA Hydraulic Pipe Bending Machines

Following the success of our copper tube bending machines our range of Hydraulic Pipe Benders has been produced to deal with all classes of heavy water, gas or steam barrel from ½" - 3" diameter. *(Model H.1 illustrated).* A special feature is our patented attachment enabling 180° bends to be effected rapidly and with ease. Model H.2 TUBELA Hydraulic Bender, the latest in our range is designed to bend heavy gauge pipes from ½" - 1¼" only and is very competitive in price. These machines are modern in every sense of the word.

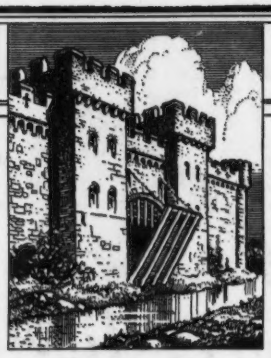
Model H.1 Hydraulic Bender

Please write for full details

LAWLER, AYERS & CO. LTD.

54 OLD BROAD STREET, LONDON, E.C.2

Tel. LONDON WALL 5101 (3 lines)



PROTECTION

GAUNTLET

GAUNTLET

WEATHER TESTED PAINTS

ARCHD H. HAMILTON & CO. LTD

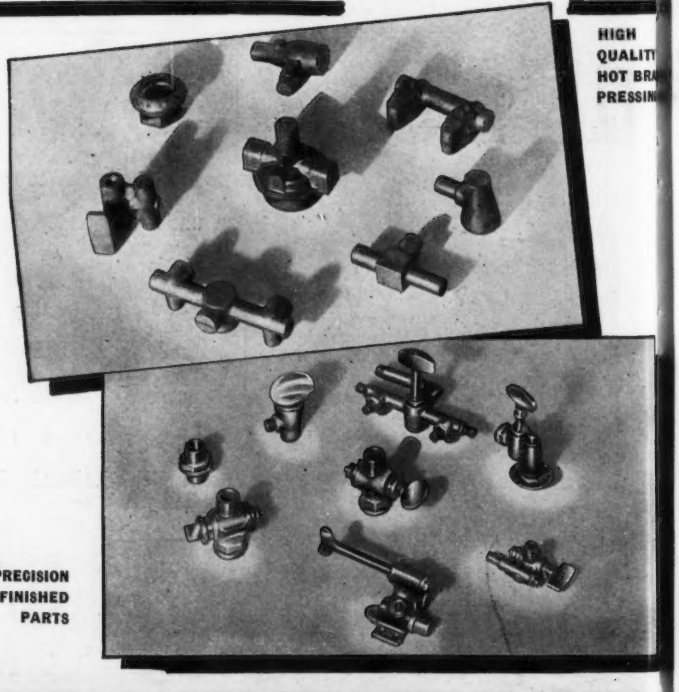
27-37 BARDOWIE STREET POSSILPARK GLASGOW N

Continuous Production

of Gas Thermostats, Governors, Regulators, Fire Injectors, Blow Pipes, Bunsen Burners and Taps for all Gas Requirements . . . . . .

Also send us your enquiries for

HOT BRASS PRESSINGS and STAMPINGS. *These can be supplied as stamped at precision machined finish to customers requirements. Typical examples are here illustrated.*



HIGH QUALITY HOT BRASS PRESSINGS

PRECISION FINISHED PARTS

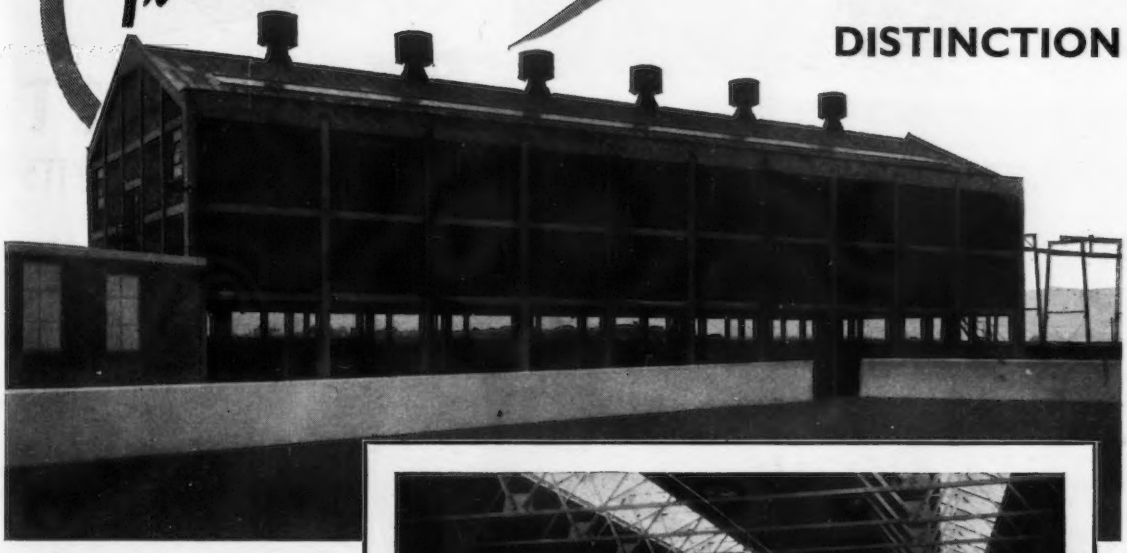
MESSENGER & SONS (BIRMINGHAM) LIMITED

PERCY ROAD, GREET, BIRMINGHAM, 11

TELEPHONE : VICTORIA 1071/2 TELEGRAMS : MESSENGERS, BIRMINGHAM

Purifiers by Claphams

PLANT OF DISTINCTION



MODERN H_2S PURIFIERS

Heating & Humidifying Equipment.
Labour-Saving Oxide Handling Plant.
Buildings & Foundations.

COMPLETE INSTALLATIONS

Scientifically designed to the last detail to suit individual conditions.

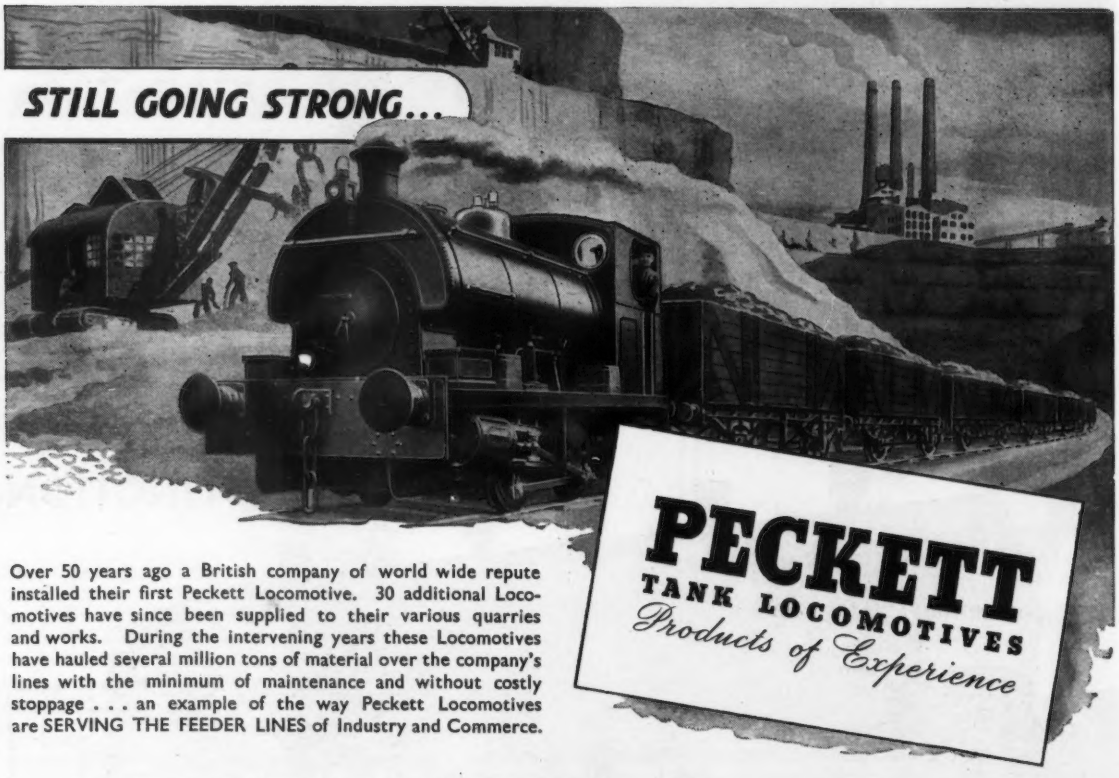
Deck Level

Service & Thoroughness - May we deal with your problem?

CLAPHAM BROS. LIMITED

MAKERS OF GAS WORKS EQUIPMENT SINCE 1837

KEIGHLEY-YORKS - Tel: 2787-2788 - Grams: "Clapham Bros., Keighley."



Over 50 years ago a British company of world wide repute installed their first Peckett Locomotive. 30 additional Locomotives have since been supplied to their various quarries and works. During the intervening years these Locomotives have hauled several million tons of material over the company's lines with the minimum of maintenance and without costly stoppage . . . an example of the way Peckett Locomotives are SERVING THE FEEDER LINES of Industry and Commerce.

London Representatives: Ferguson & Palmer, 9, Victoria Street, Westminster, S.W.1.

PECKETT AND SONS LTD. ATLAS LOCOMOTIVE WORKS, BRISTOL, 5.

'Phone: Fishponds, Bristol 53006. *Telegrams:* Peckett, Bristol.

FROM THE RAW MATERIAL TO THE FINISHED ARTICLE

PIPE FITTINGS

Crane pipeline equipment, which is made to British standards and has many exclusive features, includes pipe fittings of every type and size — Cast Iron Flanged and Malleable Iron Screwed Fittings (banded or plain). The strictest control is exercised throughout every production stage from laboratory testing of raw materials to the final finishing operations and tests for strength and flawlessness.

TAPER THREADS

To ensure stronger and more reliable joints Crane Malleable Iron Fittings have taper threads, which engage the pipe in a full metal-to-metal joint.

OTHER PIPELINE FITTINGS Valves of every type for water, steam, oil and air; unions, expansion joints, flanges; pipe hangers and brackets; steam traps, fabricated pipework, cocks, gun metal screwed fittings etc.

CRANE

FITTINGS FOR ANY PIPELINE

Part of the Crane Malleable Iron Foundry.

General view of the Crane Malleable Iron Machine Shop.

A close-up view of a three-way tapping machine.

Each individual fitting is tested for soundness.

CRANE LTD., 45-51 LEMAN STREET, LONDON, E.1. Works : IPSWICH

BRANCHES : BIRMINGHAM, BRENTFORD, BRISTOL, GLASGOW AND MANCHESTER

The 'CP' RANGE OF SPACE HEATERS FOR ALL REQUIREMENTS

CERTIFIED PERFORMANCE

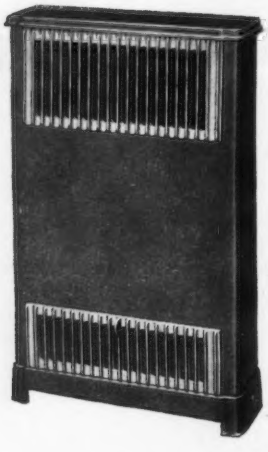
10 CU. FT. PER HOUR

20 CU. FT. PER HOUR

30 CU. FT. PER HOUR

CONVECTOR TYPE 'B'

Rating 10 cu. ft. (C.V. 500) 5,000 B. Th. U. per hour. Amber glass panel at base. For Shops, Offices and the Home. Bronze or Copper finish.



THE 'CP' WINDSOR

Rating 20 cu. ft. (C.V. 500) 10,000 B.Th.U. per hour. Fine design and high efficiency are incorporated in this heating unit, whilst its sturdy construction ensures long service.

FACTORY RADIATOR

Minimum rating 30 cu. ft. (C.V. 500) 15,000 B.Th.U. per hour. For Factories, Workshops, etc. Bronze finish.

COWPER PENFOLD & CO. LIMITED

IMPERIAL COURT, 6, BASIL STREET, KNIGHTSBRIDGE, S.W.3

Telephones KENsington 3677 & 3678

★ Factory re-conditioned engines, gearboxes and rear axles all off the shelf!

★ Service parts ready to fit

★ Standard time allowances for repair work

★ Factory-trained mechanics

Now *that's* what I'd call *real* service!

MORRIS - COMMERCIAL SERVICE keeps your vehicle in first-class condition all the time. It offers genuine re-conditioned units and service parts made to the same specifications as those originally built into your Morris-Commercial. It offers the skill and know-how of factory-trained mechanics. And all this at reasonable rates based on standard times. You know beforehand how long the job will take and quite apart from the job being done *better*, it is done more economically, more efficiently and in the right spirit.

MORRIS-COMMERCIAL

NUFFIELD PRODUCTS

MORRIS COMMERCIAL CARS LTD., ADDERLEY PARK, BIRMINGHAM, 8.

Overseas Business: Nuffield Exports Ltd., Oxford and 41, Piccadilly, London, W.1.

S-4

FOUR OAKS

FOR LABOUR-SAVING AND EFFICIENT SPRAYING

These sprayers are both labour-saving and effective in performance. They have proved themselves in many gas undertakings, and gas engineers using them consider they are all that we claim for them. Specialising in spraying apparatus, our wide range of productions includes machines for white-washing, disinfecting, creosoting and paint spraying. Tell us your spraying problem—our long experience can help you

The "FOUR OAKS" Gold Medal "Bridgwater" Pattern

The special feature of this pump is that the pump bucket works entirely outside the liquid.

18 Gallons,

Other patterns of smaller capacity and lower prices.

Prices on application.

THE FOUR OAKS SPRAYING MACHINE CO.,
FOUR OAKS WORKS · FOUR OAKS · BIRMINGHAM.
Telegrams: "SPRAYER, FOUR OAKS." *Telephone: FOUR OAKS 305.*

Tools and Appliances for Gas and Water Distribution

PHONE DENTON 2691/2

E. PASS & Co LTD.
GAS & WATER ENGINEERS. DENTON. LANCS.

TELEGRAMS TOOLS DENTON. LANCS.

100 years ago

The Slave Trade

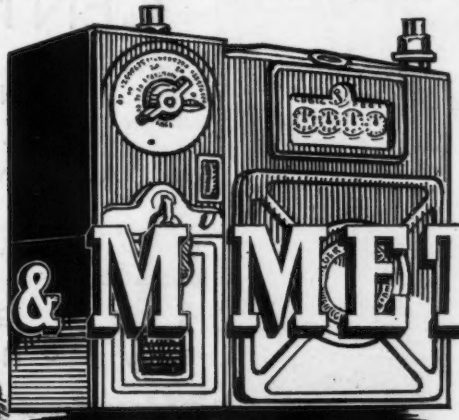
THE SLAVE TRADE.—After more than thirty years' experiment, during which we have expended from £700,000 to one million pounds per annum in policing African waters, the horrible trade, though its prices and its channels have been disturbed, remains in amount as great as, and in cruelty greater than ever. Our cruisers have only made the trade more hazardous, and consequently thrown it into more desperate hands, and forced the employment of crueller means. The slave-dealer incurs great losses by captures, and by the deaths caused by the greater haste and closer packing necessary in a smuggling or piratical trade; but for whatever proportion of his purchases he succeeds in bringing to Cuba or Brazil, he receives a profit of 75 per cent. The question of the continuance of the African squadron is one of the most uninviting and the most perplexing that has been recently stirred. There is a strong national reluctance to confess defeat and abandon effort in a cause so noble [illegible] its this which weighs against the [illegible] cost of the [illegible] results, and [illegible] events [illegible] facts [illegible] weight [illegible] in[illegible]

who [illegible] in Lond[illegible] strategic[illegible] Commit[illegible] of the[illegible] countri[illegible] the follo[illegible] "The [illegible] this af[illegible] Foreig[illegible] the D[illegible] Finan[illegible] "T[illegible] actio[illegible] conth[illegible]

MAN has ever been his own worst enemy, that has often been proved by his resistance to the introduction of the machine.

In 1743 he fought against the innovation of the power loom — in 1845 against the sewing machine — in 1882 against the typewriter. Even today he is resisting the introduction of new machines. And this despite the fact that whenever man has made the machine his slave, his productivity has increased many times with less physical effort and with an improved standard of living.

Whatever may have been said against the Gas Meter 100 years ago is as forgotten as the "peep of gas." Today the A. & M. Meter is the faithful geni of the enlightened gas engineer and we are rightly proud of our 100 years' contribution to the betterment of mankind.



The A & M METER

Celebrating
100 YEARS SERVICE
to the
GAS INDUSTRY

A Complete

First Aid Service

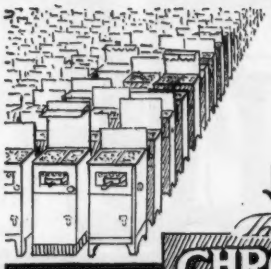
FOR INDUSTRY

BY THE PIONEERS OF INDUSTRIAL FIRST AID

We invite you to write for a copy of our Illustrated Price List

FIRST AID CASES
SURGICAL DRESSINGS
MEDICINAL REQUISITES
AMBULANCE SUNDRIES
AND
AMBULANCE ROOM FURNITURE

CUXSON, GERRARD & CO. LTD.
OLDBURY · BIRMINGHAM



Over 200 Gas Undertakings have TESTED & CHOSEN for use

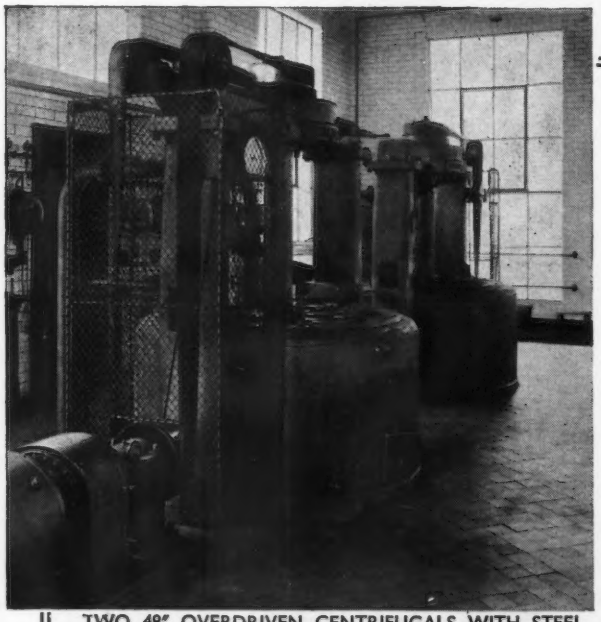
The CHROME GRILL DEFLECTOR

Patent No. 520940

Available for all types of Gas Cookers.
Becomes incandescent in 40-60 seconds and gives 3,700 heat hours on alternate heating and cooling
Made from
HEAT RESISTING CHROME STEEL.

Manufactured under licence by

H.B.DREW, LIMITED.
Western Works,
Perivale, Greenford Mddx.
'PHONE: PERIVALE 3238. 'GRAMS: 'GASFRET, GREENFORD'



TWO 48" OVERDRIVEN CENTRIFUGALS WITH STEEL BASKETS DRIVEN BY SINGLE SPEED FLAME-PROOF MOTOR AND BELT THROUGH VARIABLE SPEED HYDRAULIC COUPLING

BROADBENT CENTRIFUGALS

FOR
ANTHRACENE
NAPHTHALENE
AMMONIUM SULPHATE
AND ALL
CRYSTALLINE
OR
GRANULAR
MATERIALS

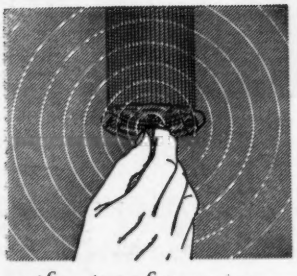
DIRECT ELECTRICALLY-DRIVEN
OR BY
SEPARATE MOTOR AND BELT
WITH ACCESSORIES FOR SPECIFIC DUTIES

THOMAS BROADBENT & SONS LTD.

TELEPHONE 5520 (6 lines) HUDDERSFIELD

STANMORE EXPERIMENT COMPLETELY SUCCESSFUL

Comfort throughout the house *at a touch*



There could hardly be a better test of satisfactory whole-house warming than that of *uniformity of temperature,* in all parts of the house. The Stanmore findings on this score were surprisingly good. The mean recordings, taken over a nine-month test in all weather conditions, showed a variation from thermostat settings in any room of as little as 2°F on the horizontal plane and 6°F on the vertical.

Details of the Stanmore experiment have been published and will be gladly sent to enquirers. Meanwhile we cordially invite architects, housing authorities and others —especially those concerned with appliances suitable for smokeless zones— to visit the Stanmore houses.

But please apply first for an appointment to Radiation Ltd., Aston, Birmingham 6, telephone: Birmingham East 1752, or 7/8 Stratford Place, London, W.1., telephone: MAYfair 6462.

Whole-house warming by Radiation ducted air

When washing machines are Acme-fitted **then** women know they're buying the best . . .

WOMEN are buyers of washing machines. Women are buyers of wringers. And when women think of wringers they think of the Acme. So when your machines are Acme-fitted your customers know that they must be, like the Acme, the best on the market.

Seventy years of good, solid British manufacturing, skill, research, and experience stand behind each Acme—and generations of women know this to be true. Acme is the perfect expression of real and continuous progress in the history of wringing. Thus, every feature for which Acme is famous, has sprung from a known need; has been tested, tried and found successful before it leaves the factory.

Today the new Acme has "pressure indication", a development which, by assuring the correct pressure for every kind of fabric, takes the guesswork out of wringing. Silks, cottons, woollens, linens, now receive exactly the right pressure needed to extract water, expel embedded dirt and preserve the life of each fabric. Thus wringing is made simpler and easier.

Acme does a better job, lasts longer and gives the best results. That's why Acme's reputation is world wide. That's why more than four million women have chosen an Acme in preference to all others. That's why, when your washing machines are Acme-fitted, women know they're buying the best.

ACME WRINGERS LIMITED DAVID STREET GLASGOW SE

INDEX TO "JOURNAL" ADVERTISERS

PAGE

A
A.C.E. Machinery, Ltd. ...
Abbott, Birks & Co., Ltd. ... 7
Accurate Recording Instrument Co.
Acme Wringers, Ltd.
Aerogen Co. Ltd. ... 32
Albright & Wilson Ltd.
Alder & Mackay, Ltd. ... 29
Allied Ironfounders, Ltd.
Ascot Gas Water Heaters, Ltd.
Ascot Gas Water Heaters, Ltd. (F.A. Neat)
Ashmore, Benson, Pease & Co., Ltd.
Ashworth & Parker, Ltd. ...
Aspinall's (Paints), Ltd. ... S4
Associated Lead Manufacturers, Ltd. ...
Associated Lead Manufacturers, Ltd. (Rustodian) 21
Automatic Telephone & Electric Co., Ltd.
Automotive Products, Ltd.
Averill, C. R., Ltd. ...

B
Bagnall, W. G., Ltd.
Bailey, Sir W. H. & Co., Ltd.
Bale & Church, Ltd. S3
Balfour, Henry, & Co., Ltd.
Bardic, Ltd.
Begwaco Meters, Ltd.
Bell's Asbestos & Engineering, Ltd. ... Cover I
Benham & Sons, Ltd.
Birtley Co. Ltd.
Boltons Superheater and Pipeworks, Ltd.
Bottomley, Thomas, (Grids) Ltd. ... S2
Boydell, E., & Co., Ltd.
Braddock, J. & J.
Bratt Colbran, Ltd.... 7
Bray, George, & Co., Ltd....
Bray, W. E. & Co., Ltd. S4
Bright, Son & Co.
Bristol's Instrument Co., Ltd. 1
British Flint & Cerium Manufacturers, Ltd.
British, Foreign & Colonial Automatic Light Controlling Co., Ltd.
British Furnaces, Ltd.
British Gas Purifying Materials Co.
British Industries Fair
British Paints, Ltd. ...
British Tyre and Rubber Co., Ltd.
British Vacuum Cleaner & Engnrg Co., Ltd.
Broadbent, J. C., & Co., Ltd. 30
Broadbent, Thomas, & Sons, Ltd.
Brockhouse Heater Co., Ltd.
Broom & Wade, Ltd.
Brotherhood, Peter, Ltd. ...
Brown, J., & Co., Ltd. S1
Bugden, Thos., & Co.

C
Cannon Iron Foundries, Ltd. 2
Carron Co. 8
Cementation Co., Ltd., 14
Chance Bros., Ltd. ...
Chaseside Engineering Co., Ltd.
Cheltenham Meters Ltd.
Chemical Engineering & Wilton's Patent Furnace Co., Ltd.
Chemical & Insulating Co., Ltd. 23
Clapham Bros., Ltd.
Clayton, Son & Co. Ltd. ...
Clifford Engineering Co., Ltd.
Clough (Croydon) Ltd. 6
Cochran & Co., Annan, Ltd.
Collins, Thomas, & Co., Ltd. 17
Concrete Proofing Co., Ltd. 12
Consolidated Pneumatic Tool Co., Ltd. 26
Cowper Penfold & Co., Ltd. S2
Cox & Danks, Ltd.... 25
Crane, Ltd. ... 10
Crone & Taylor, Ltd.
Curtis, Algernon Lewin
Cutler, Samuel, & Sons, Ltd. 30
Cuxson Gerrard & Co., Ltd.

D
De la Rue, Thomas, & Co. Ltd. (Potterton Gas Division) ...
Dempster, R. & J., Ltd.
Dempster, Robert, & Sons, Ltd. ...
Derbyshire Silica Firebrick Co., Ltd.
Dewrance & Co., Ltd.
Diaphragm & General Leather Co., Ltd.
Dick, R. & J., Ltd. ... Cover II
Donkin (The Bryan) Co., Ltd. ...
Douglas, Robert M. (Contractors) Ltd. ...
Douglas, William, & Sons, Ltd. ...
Drag Scraper & Engineering Co., Ltd. ...
Drakes Ltd. ... 30
Drew, H. B., Ltd. ...
Drivall, Ltd. ...
Dunlop Rubber Co., Ltd. (General Rubber Goods Division) ... Cover IV
Dunlop & Ranken, Ltd. ...

E
Eagle Range & Grate Co., Ltd. ...
E.B. Refractory Cement Co., Ltd.
Edgar, William, & Son, Ltd
Electro-Depositing Co., Ltd. 21
Electroflo Meters Co., Ltd. 9
Electrolux, Ltd. ...
Elliott Bros. (London), Ltd.
Erskine, Heap & Co., Ltd. 2
Ether, Ltd. ...
Evans, Joseph & Sons (Wolverhampton) Ltd.
Evershed & Vignoles Ltd. ... S1
Ewart Chainbelt Co. Ltd. ...
Ewart & Sons, Ltd.
Expanded Metal Co., Ltd....

F
Falk Stadelmann & Co., Ltd ...
Fibreglass, Ltd. ...
Filtrators, Ltd. ...
Firth, Blakeley, Sons & Co., Ltd.... 50
Flavel, S., & Co., Ltd. ...
Fluxite, Ltd. ... 28
Four Oaks Spraying Machine Co., Ltd. ...
Franki Compressed Pile Co., Ltd.... 15
Fraser & Chalmers, Engineering Works ...
Fry's Metal Foundries, Ltd. ... 18

G
Gas Chambers & Coke Ovens, Ltd. ... S3
Gas Purification & Chemical, Ltd. ...
General Descaling Co., Ltd. ... 1
General Gas Appliances, Ltd. ... 36
Gibbons Bros., Ltd. ...
Gibbons (Dudley), Ltd. ...
Girdex Engineering Co. Ltd. ...
Glover, George, & Co., Ltd. ...
Glover, Thomas, & Co., Ltd. ...
Goodacre, William & Sons, Ltd....
Goodall Clayton & Co., Ltd. ...
Goodyear Mechanical Goods ... 8
Grant, David, & Co., Ltd.... S1
Graphite Products, Ltd. ...
Green & Boulding, Ltd. ...
Guest, Keen & Nettlefolds (Cwmbran), Ltd. ...
Gunite Construction Co., Ltd. ...

H
Hamilton, A. H., & Co., Ltd. ... 52
Hardman & Holden, Ltd. ... S2
Harris & Pearson, Ltd. ... S3
Harrisons (London), Ltd. ... 17
Hawkins, W. T. & Co., ...
Head Wrightson Processes, Ltd. ...
Helliwells, (Treforest) Ltd. ...
Hewitt Construction Co., Ltd. ...
Hilmor, Ltd. ...
Holden & Brooke, Ltd. ... S5
Holmes, W. C., & Co., Ltd. ...
Honeywell-Brown, Ltd. ...
Hopkinsons Ltd. ...
Horseley Bridge & Thomas Piggott, Ltd. ...
Horstmann Gear Co., Ltd. ...
Howden, James & Co., Ltd. ... 34
Humphreys & Glasgow, Ltd. ...
Hurseal, Ltd. ...

I
Ideal Boilers & Radiators, Ltd. ...
I.C.I. Metals, Ltd. ...
Incandescent Heat Co., Ltd. ...
Ingham, John, & Sons, Ltd. ...
International Coin Counting Machine Co., Ltd.
International Combustion, Ltd. ...

J
Jeavons, E. E., & Co., Ltd. ... S1
Jeavons Engineering Co. ...
Jenkins, W. J., & Co., Ltd. ...
Jenolite, Ltd. ...

K
Keay, E. C. & J., Ltd. ...
Keith Blackman, Ltd. ... S6
King, George W., Ltd. ...
King, Walter, Ltd. S1 S3
Kings Patent Agency, Ltd. ... S4
Kirk & Co. (Tubes) Ltd. ...
Kirkham Hulett & Chandler, Ltd. ...
Kleen-e-ze Brush Co., Ltd. ...
Kleenoff Co.... ... 10
Klinger, Richard, Ltd. ...

L
LaFarge Aluminous Cement Co., Ltd. ...
Laidlaw, R., & Son (Edin.), Ltd. ... 12
Lamont, James H., & Co., Ltd. ...
Lancashire Dynamo & Crypto, Ltd. ...
Lawler, Ayers & Co., Ltd. ... 22
Lead Industries Development Council ...
Lee Bas Tube Co., Ltd. ...
Leeds X.L. Fire Cement Co. ... S4
Lind, Peter, Ltd. ...
Lomax & Smith, Ltd. ...
Londex Ltd.... ...
London Electric Firm Ltd.... ...
London Welding Co., Ltd., ...

M
Macpherson, Donald, & Co., Ltd. ...
Main, R. & A., Ltd. ...
Marco Conveyor & Engineering Co., Ltd. ... 16
Mason E.N. & Sons, Ltd.... ...
Mavor & Coulson, Ltd. ... 13
Meltham Silica Fire Brick Co., Ltd. ...
Messenger & Sons, Ltd. ... 22
Metropolitan Leather Co., Ltd. ...
Milnes Meters, Ltd. ... 24
Mitchell, H., & Co.... ...
Morris Commercial Cars, Ltd. ... 27

N
Nash & Thompson, Ltd. ...
National Benzole Co., Ltd. ...
Neil & Spencer, Ltd. ...
Newton Chambers & Co., Ltd. ...
Niagara Screens (G.B.), Ltd. ...

O
Oxley Engineering Co., Ltd. ... Cover II

P
Parkinson & Cowan (Gas Meters), Ltd. ... 36
Parkinson Stove Co., Ltd. ...
Pass, E., & Co., Ltd. ... 28
Payne & Flood, Ltd. ... S4
Peckett & Sons, Ltd. ... 24
Peebles & Co., Ltd.... ... 53
Perl Controls, Ltd. ...
Platt, Samuel, Ltd. ...
Power Gas Corporation Ltd. ...
Power Master, Ltd.... ...
Powers-Samas Accounting Machines (Sales) Ltd.
Press, William, & Son Ltd.... ... 20
Pulsometer Engineering Co., Ltd. ...

R
Radiant Heating, Ltd. ...
Radiation, Ltd ... 31, 42, 43
Rawlplug Co., Ltd. ...
Reavell & Co., Ltd.... ... S1
Riley, A. J. & Son, Ltd. ...
Ronco Ltd. ...
Royles, Ltd. ...
Rozalex, Ltd. ...
Russell, R., & Sons Ltd. ... S2

S
S. & F. Contracting Co., Ltd ... 35
Salter, T. E., Ltd. ... 5
Saunders Valve Co., Ltd. ... S1
Scottish Non-Ferrous Tube Industries, Ltd. ...
Siebe Gorman & Co., Ltd ...
Simon-Carves, Ltd.... ...
Simon, Richard, & Sons. ... 16
Sisson, W., & Co., Ltd. ...
Slingsby, W., & Co., Ltd. ...
Smith Meters, Ltd.... ...
Spencer Bonecourt, Ltd. ...
Sperryn & Co. ...
Standard Furnace & Setting Co. Ltd. ...
Stanton Ironworks Co., Ltd. ...
Staveley Iron & Chemical Co., Ltd. ...
Steel Equipment Co., Ltd.... ...
Stein, John G., & Co., Ltd. ...
Stelcon (Industrial Floors) Ltd. ...
Stewart & Gray, Ltd. ... 11
Stewarts & Lloyds, Ltd. ...
Stoves, Ltd. ... ...
Strachan & Henshaw, Ltd. ...
Stringer Bros. ...
Sugg, William, & Co., Ltd. ...
Sutcliffe Speakman & Co., Ltd. ...
Sutherland, A. G., Ltd. ...
Swallow Coachbuilding Co. (1935) Ltd. ...

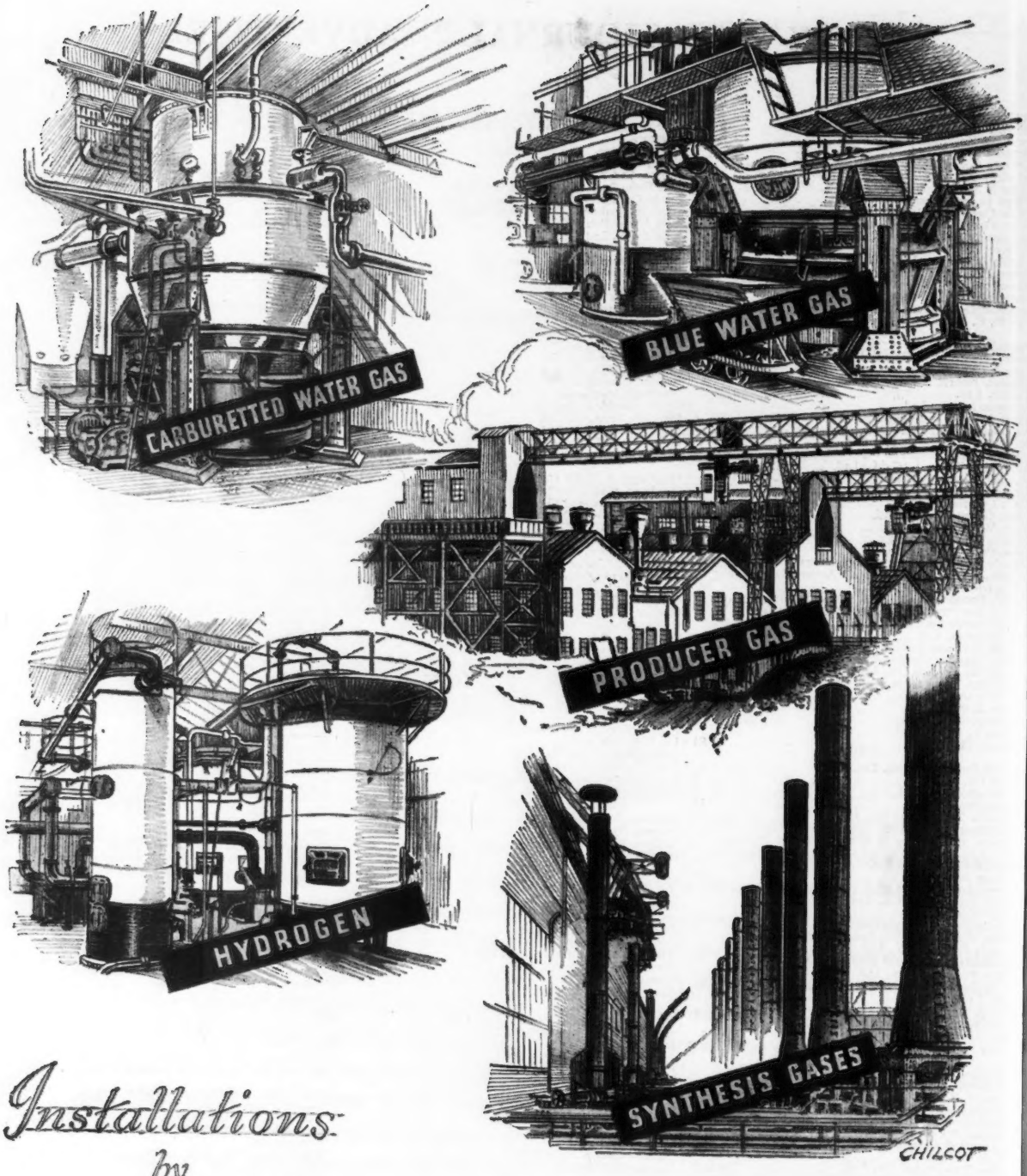
T
Tarslag, Ltd. ...
Taylor, F. & Sons, Ltd. ... 51
Thomas & Bishop, Ltd. ...
Thomas (Richard) & Baldwins, Ltd. ...
Thompson John, Conveyor Co. ...
Tully, Sons & Co., Ltd. ...
Turners Asbestos Cement Co., Ltd. ...

U
Ufix Boiler Co., Ltd. ...
Underpressure Engineering Co., Ltd. ... S4
United Kingdom Construction & Engineering Co., Ltd. ...

V
Vale, Thomas, & Sons, Ltd. ...
Vanda Meters, Ltd.... ...
Visco Engineering Co., Ltd. ...
Vulcan Stove Co., Ltd. ...

W
Wailes Dove Bitumastic, Ltd. ... 4
Wakefield, C. C. & Co., Ltd. ... 49
Wakelin, F. H., Ltd. ...
Walker, C. & W., Ltd. ...
Walker, Crosweller & Co., Ltd. ...
Waller, George, & Son, Ltd. ...
Ward, Thos. W. Ltd. ...
Wellington Tube Works, Ltd. ...
Wellman Smith Owen Engineering Corpn., Ltd. ... 54
West's Gas Improvement Co., Ltd. ... Cover III
West Hunwick Silica & Firebrick Co., Ltd. ...
West's Piling & Construction Co, Ltd. ...
Westwood & Wrights, Ltd. ... S1
Whessoe, Ltd. ... 3
Whitehouse, Wm., & Co., Ltd ...
Whittaker Ellis, Ltd. ...
Wilkes, A. H. & Co., Ltd. ...
Willey & Co., Ltd ...
Williams, John E., Ltd. ...
Williamson Cliff, Ltd. ...
Wilson, George, Gas Meters, Ltd. ...
Winn & Coales, Ltd. ...
Woodall-Duckham Vertical Retort & Oven Construction Co. (1920), Ltd ... 41
Wood, Hugh & Co., Ltd. ... 19
Wright, Alexander, & Co., Ltd. ...

Appointments Vacant ... S3, S4
Appointments Wanted ...
Business For Sale ...
Contracts Open ... S4
Financial ... S4
Miscellaneous ... S4
Office Accommodation ...
Patents ... S4
Plant For Sale ...
Publications ...
Repairs ... S4



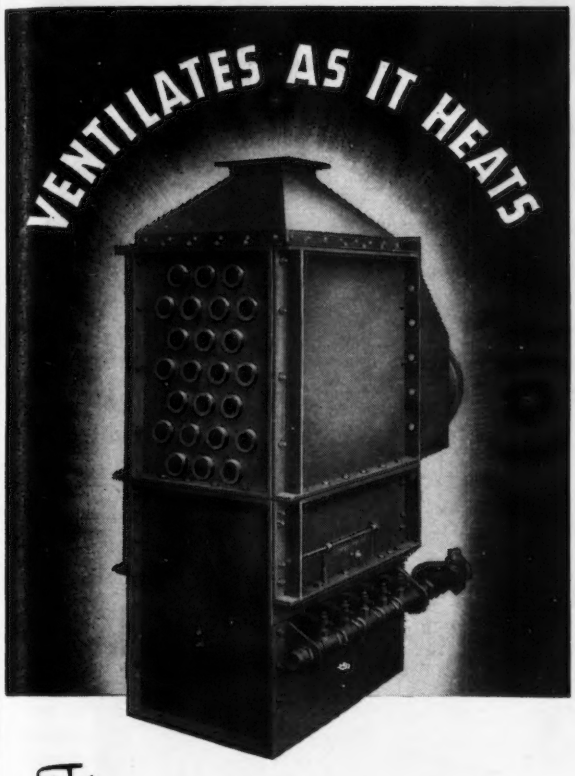
Installations by

HUMPHREYS & GLASGOW LTD.

HUMGLAS HOUSE · CARLISLE PLACE · LONDON · S.W.1

Telephone VICtoria 3961

ESTABLISHED 1892



The

VOLEX

REGISTERED TRADE MARK

WARM AIR SYSTEM

is recognised as the most efficient and economical system of Heating and Ventilation for Schools, Clinics, Churches, Shops, Offices, Factories, Workshops and all buildings where a pleasant equable atmosphere—essential to health and efficiency—is required. It maintains an even temperature and draughtless ventilation all the year round, and the air in the building can be changed as often as desired according to the processes carried on. The heaters are made either for gas-firing, hand-firing, worm feed stokers or oil firing.

Enquiries invited by the Sole Makers:—

T. E. SALTER LTD. TIPTON, STAFFS
TELEPHONE: TIPTON 1657/1658.

Gas Journal

102nd YEAR OF PUBLICATION

EDITOR: NORMAN S. SMITH, B.Sc.(Gas Eng.)

11, BOLT COURT, FLEET ST., LONDON, E.C.4.
Telephone: CENtral 2236-7.
Telegrams: Gasking, Fleet.

VOL. 263 NO. 4544 JULY 5, 1950

CONTENTS

Page

EDITORIAL COMMENT

The Producer ... 37
Pension Rights and Wrongs ... 38
More About Concrete ... 38

RETROSPECT

100 Years Ago ... 39

NEWS OF CURRENT EVENTS

Personal ... 39
Diary ... 40
1950 'Journal' Directory ... 40
Gas to the Rescue ... 44
The Royal Show ... 44
Compensation Values ... 44
Research Fellowship ... 44
Rating of Gas Undertakings ... 44
Manufacture of Refractory Materials: Manchester Juniors Visit Derbyshire Works ... 45
Black Cookers Scrapped ... 46
North Western Aims ... 46
Windermere Meeting ... 46
Developments in the Perth Area: Sir Edgar Sylvester Inaugurates Bulk Supply to Coupar Angus ... 47
Wakefield Careers Exhibition ... 48
Midland Juniors Ladies' Day ... 48
West Midlands Gas Prices ... 48

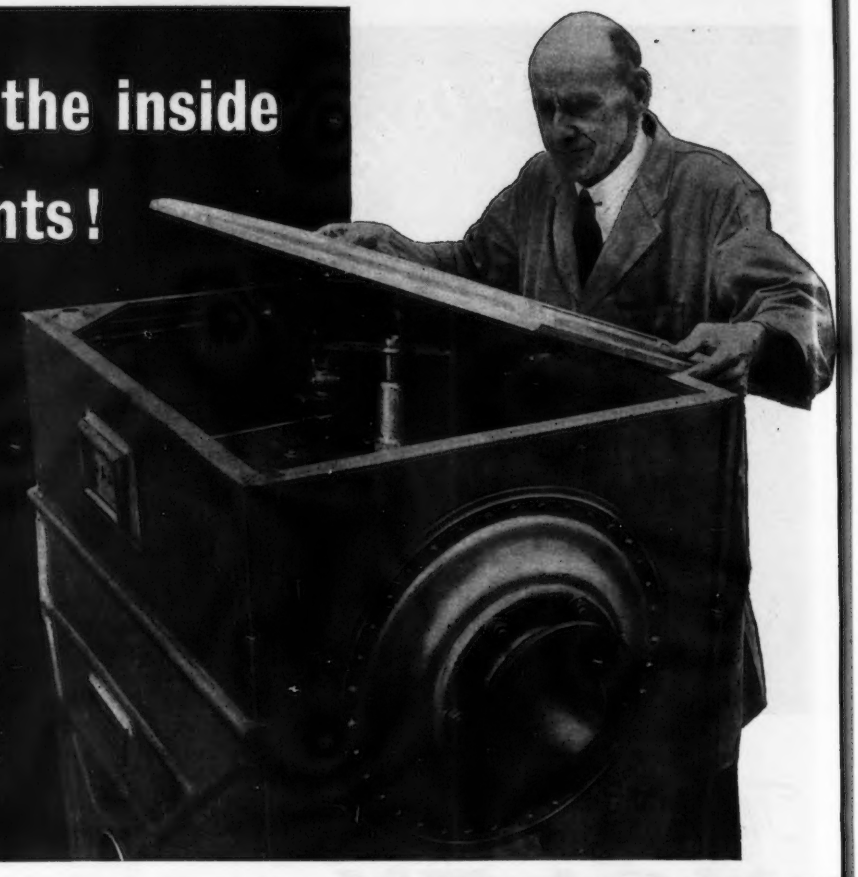
GAS UNDERTAKINGS' RESULT

Imperial Continental Gas Association ... 51

Publishers' Notice : See page S3.

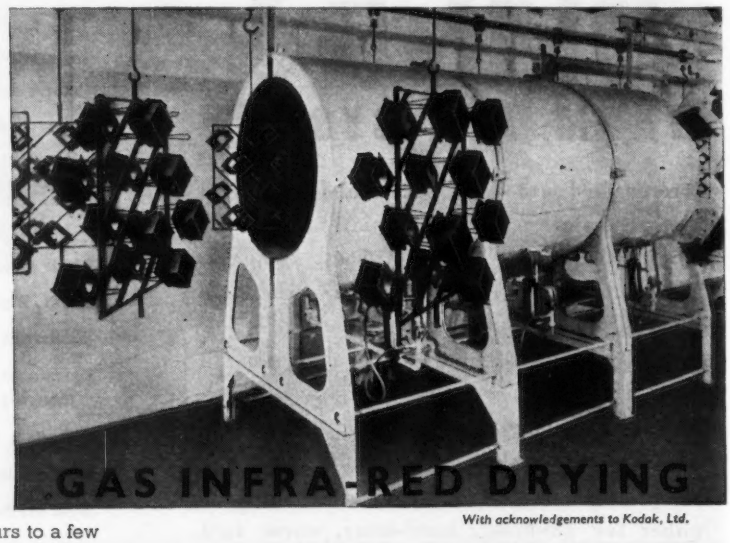
Gas Journal ..... Walter King Ltd.

yes – it's the inside that counts!



THOMAS GLOVER
& CO. LTD., EDMONTON
LONDON, N.18 & BRANCHES

Smile please



With acknowledgements to Kodak, Ltd.

The rapid drying of these freshly painted camera bodies is just cause for a smile of satisfaction— Our Gas Infra-Red Drying Tunnels, cut time spent on paint drying from hours to a few minutes and maintain a smooth uninterrupted flow of production. The associated conveyor and spray equipment contributes further savings in handling and spraying time. The total cost of the finishing process is thereby reduced considerably.
We should be pleased to give any advice you may desire on the layout of your finishing or other heat processes.

WHETHER YOU MAKE:— **CAMERAS · KITCHEN CABINETS · BICYCLE FRAMES · ELECTRIC MOTORS · PREFAB. UNITS ETC. ETC.** the Parkinson & Cowan units can easily be incorporated in your present production line, to dry freshly painted products quickly and efficiently.

PARKINSON & COWAN (Gas Meters) LTD

ENGINEERING DIVISION, Cottage Lane, City Road, London E.C.1. Telephone: CLErkenwell 1766

IR10

GAS JOURNAL

VOL. 263. NO. 4544 102ND YEAR JULY 5, 1950

THE PRODUCER

WITH twice as much experience, both in time and in bulk, the British gas engineer has been far more reluctant than his Continental colleague to adopt the mechanical producer for heating retort settings, whether horizontal or vertical. The bar grate has given way to the step grate and the latter has been put under pressure, but until the last few years all attempts to introduce the mechanical producers have failed to make good. Probably the main reason for this lack of success has been their high capital and maintenance costs. They have relieved the retort house of one of its heaviest jobs but it has been difficult to see any such definite saving in labour or fuel cost as to justify the higher expenditure. And the discussion of the excellent paper by Mr. W. S. Hubbard at the annual meeting of the Institution of Gas Engineers left it clear that there still exist grave doubts whether this higher expenditure is justified. On the day's play the step grate makes a very good show. But, to go first to the end of the paper, it must be admitted that the manually clinkered producer remains one of the objectionable features of modern carbonising plant and it is probable that the undoubted superiority in thermal efficiency of the modern step grate will not save it from the scrap heap. The actual labour involved in the cleaning of the step grate of adequate proportions may not be very much more than that of rodding the mechanical producer, but it is a constant routine task in the former as against the sporadic effort of the latter.

The mechanical grate, then, has probably come to stay. All attempts to apply mechanical clinkering to the step grate having failed, the adoption of some form of more or less circular producer appears to be inevitable. 'It is difficult to imagine,' says Mr. Hubbard, 'a well designed and efficiently operated mechanical producer installation being allowed to revert to step grates, even though it may involve what is, after all, a comparatively insignificant financial saving when viewed against the background of the process as a whole'—and even though one may doubt whether it effects any financial saving at all, and even though we were informed that one of the most progressive and efficient undertakings in the country had, in fact, gone back to the step grate.

The position appears to be that there are now three schools of thought on the subject of heat supply to retort settings—those who favour the supply of cold cleaned gas, those who wish to retain the sensible heat in the producer gas and yet clean it before it enters the combustion chambers, and those who would be content with hot de-dusted gas, under which last heading may be included those who would retain the step grate and take as much dust out of the gas as may be accomplished by some simple means.

Taking the points of Mr. Hubbard's paper in some detail we must confess to a certain amount of surprise at the claim on behalf of the mechanical producer that it enjoys a versatility in fuel utilisation not found in any other type. We suggest that this claim is contradicted by the very marked reduction in capacity when it is sought to utilise coke breeze. The fact is that all producers work at their optimum capacity with a fuel not so much large in particle size as with particle sizes over a limited range. An American of vast experience in producer design and practice is reported to have said that he would make you a producer to gasify $\frac{1}{8}$ in. fuel if you would confine the supply to that size. We remember inspecting a large producer installation on a Continental gasworks where there were six very fine producers. They were operated in three pairs, one pair gasifying something like $\frac{1}{4}$ in. to $\frac{3}{4}$ in. coke, another, say $\frac{3}{4}$ in. to $1\frac{1}{2}$ in., and the third the larger sizes. A feature of the landscape was a high mound of discarded breeze. As Mr. Hubbard himself puts it: 'It is agreed that a fuel of fairly close size ratio is desirable and it is very doubtful whether very fine material, say $\frac{1}{8}$ in., is ever gasified satisfactorily, although a certain amount may be tolerated mixed with much larger fuel.' One very interesting suggestion, however, is that the mechanical producer might be supplied with low-grade non-caking coal for retort heating. Mr. Hawthorn pointed out that the fuel gas from coal would have a calorific value of 160 B.Th.U. as against the 125 which is probably the maximum produced from coke; and it might be cheaper, at any rate at present prices.

It would appear that the real problem, that arising out

of the labour difficulty, would be solved by the mechanical grate feeding hot gas to the setting—not very different, that is, from the integral step grate—if the other problem, that of the elimination of dust, or the greater part of it, could be solved at the same time. Mr. Hubbard gives much valuable information on this point. His Centicell apparatus appears to do the job very nicely, but it is likely to be too bulky to interpose between the simple producer and the setting. Moreover, it is not certain whether a metallic dust catcher would stand up to really hot gas. At this point, there are a number of questions which call for careful consideration. For instance, is the gross quantity of dust much greater from a mechanical grate working under a moderate or low pressure than from a pressurised step grate with its periodical disturbance for cleaning? Is it possible to arrest a sufficient proportion of this dust in a simple form of intermediate chamber to reduce the nuisance in the setting to negligible proportions? And, if the labour problem is solved by the provision of the mechanical grate, is the very considerable further expenditure involved in the complete elimination of dust justified, particularly in view of the inevitable loss of sensible heat?

Operating results prove that this loss of sensible heat is serious. On the other hand a properly controlled mechanical grate delivering hot gas to the setting should even show some improvement on the step grate if only by the obviation of that troublesome recovery period following manual cleaning during which the gas composition is poor. Such a producer shares some of the advantages of the more elaborate appliance. It is self-supporting in steam, loss of fuel in ash extraction is low, and some of the more necessary automatic controls can be applied to it.

It would appear then that this time the mechanical producer has come to the British gasworks to stay. The question is whether it will stay in the form of elaborate plant delivering cold, cleaned gas to the setting, or will some simpler form, some more elegant solution of the problem, find more favour in the eyes of engineers and administrators who wish to see just what economies are to be effected to set off against an increase in the overall capital cost of carbonising plant?

PENSION RIGHTS AND WRONGS

THE current of political feeling and temperament in Parliament moves in a mysterious way. What, to an impartial observer, appeared to be a simple amendment to the Gas (Pension Scheme) Regulations, 1949, evoked in the House of Commons on June 27 a storm of protest and an exchange of acrimonious opinion. First shots were fired by Colonel O. E. Crosthwaite-Eyre, M.P. for New Forest, when he moved, on behalf of the Opposition, the annulment of the Gas (Pension Scheme) (Amendment) Regulations, 1950, a summary of which was given in last week's *Journal*, p. 949. The opinion of the Opposition was that the amendment regulations introduced a new element and something which was outside the original statutory instrument. If a new element had not been introduced, Mr. Crosthwaite-Eyre contended, there would have been no need for what he termed a 'specious proposition' that members of the Gas Council and of the area boards had to be covered by a special regulation.

His specific charge was that the Ministry had found that they had signed contracts with people to serve either on a board or the Council which involved them in commitments for pensions which they could not justify under any scheme under Section 58 of the Gas Act. It was wrong that the House should pass one set of pension regulations to cover people who had been in the industry, and have a completely different set for people who were brought in from outside the industry once it had been nationalised. It was a little unfortunate that at this stage Colonel Crosthwaite-Eyre should have confused the issue by referring to the qualifying conditions for compensation under the Gas (Staff Compensation) Regulations—eight years' service in the industry, and 30 hours a week in the service of the industry.

It was not surprising, therefore, to find that the Parliamentary Secretary to the Ministry, Mr. A. Robens, replied that he found the line of reasoning difficult to follow. The amendment, he said, was a very simple set of regulations which referred to quite specific people. It covered only people who were in the industry and then became members of an area board; a man would, if he became a member of an area board, be then allowed to calculate the whole of his service in the undertaking in which he was in pensionable employment as part of the terms of membership of the new scheme, together with the period which he served on the area board. He suggested that the Opposition had not been able to read the relevant part of the Regulations which made this point clear. This said that 'for the purpose of any such scheme as aforesaid . . . the service of any person as a whole-time member of an area board or the Gas Council may be treated as if it were service in the employment of the said board or council, if that person was subject to the scheme in question immediately before becoming such a member.'

Such logic was not palatable on a hot June night. Mr. Brendan Bracken, M.P. for Bournemouth, East, and Christchurch, rejected the 'strange explanation' by Mr. Robens. The Minister, he said, had made secret arrangements with certain persons connected with the Gas Council, and he was anxious to alter the Regulations so that he could fulfil arrangements which had never been scrutinised by the House. Asked for evidence of this, Mr. Bracken provided none. Mr. Robens repeated that the Regulations provided for the promotion of those employed in the industry from the humblest position to that of an area board member without loss of pension rights. The Opposition did not divide the House in support of the prayer for annulment.

MORE ABOUT CONCRETE

AN important aspect of the application of the new methods to concrete construction, brought out in in the discussion of the valuable paper by E. O. Rose and W. T. Gedge, is that of the increased dependence it involves on the conscientious workmanship of those engaged in it. Concrete is not alone in this respect. In steel construction, in which welding plays an increasing part, there is the same dependence on honest workmanship. Bad riveting can, indeed, be detected and

replaced, but the detection of faulty welding is either impossible or a very costly and laborious business. The discussion prompted us to a number of questions. We find, for instance, that it is usual to apply vibration in the production of smallish, prefabricated concrete parts, but we are not so clear about its application to big masses of concrete *in situ*. Immersion vibrators have been used in this field and it is stated that provided the concrete has a reasonable 'slump' (to avoid air locks), the positions of the vibrators are judiciously selected and the time of vibration is limited, there should be no segregation. Freyssinel says that segregation, the drawing away of cement and sand from the coarse aggregate, may be avoided by putting the concrete under pressure, which one would think would be practicable only in prefabricated work.

We were rather surprised to hear Mr. White's emphatic preference for rounded aggregates, which, he said, 'had increased the strength of concrete by nearly 100% over that of crushed stone.' We were brought up in the view that clean, sharp, well-graded aggregate was the ideal—though we well remember some heavily loaded reinforced concrete columns built, to our dismay, some 30 years ago with an aggregate of small, smooth, seaside pebbles; they are standing, as far as we know, to this day! In part support of Mr. White there is M. Freyssinel's remark, 'a disordered mass of pyramids of square base and equal size would have a very high percentage of voids' (would be a very bad aggregate), 'but if the pyramids be appropriately arranged' (as could be done by vibrating), '100% compaction may be obtained.' There is room in next year's Juniors' programmes for a good paper, in some detail, disscussing the practice of vibration in the reinforced concrete structures of the gasworks.

Then there is definitely something in Mr. White's call for the further advance which might be made in proportioning concrete on the basis of the surface area of the materials used. The old specifications called for definite proportions of aggregate, sand, and cement without any very definite prescription of particle sizes and nothing about water—this last being left to the discretion and experience of the site supervisor or even of the actual mixer. The surface area of the materials will, of course, depend upon their grading. The use of an excess of fine materials leads to excessive surface, though good compaction, but this can also be obtained by using, where otherwise permissible, larger well-graded aggregate with a smaller total surface to be wetted with cement and water.

A point mentioned by Freyssinel and by Mr. Dougill is that of the use of inhibitors—protective coatings applied to steel reinforcement. Caldmine (hydrated silicate of zinc) has been applied to fine wires used in pre-stressing. Mr. Dougill suggests—and the suggestion is favoured in experienced quarters—that these might be worth while in the reinforcement in the construction of liquor tanks and other structures where corrosion is a definite risk. The specially rolled wires with indentations to key into the concrete seem, now, to be deemed unnecessary. There is evidently much yet to be learned and applied in the technique of construction in this comparatively new material and it is to be hoped that this excellent paper will soon be followed by others.

Personal

Mr. **J. J. Perry** and Mr. **C. H. Knight** have retired from the service of the Cardiff undertaking of the Wales Gas Board, each after 50 years' service. Mr. Perry started as a gas fitter's apprentice and finally became a district salesman, while Mr. Knight commenced in the showroom and became senior clerk in the Consumers' Record Department.

◇ ◇ ◇

Mr. **R. H. Bone,** Sales Manager of the Cardiff undertaking of the Wales Gas Board, who, as reported in the *Journal* of June 7, has been appointed Commercial and Sales Officer of the Scottish Gas Board, was the recipient of a farewell presentation on June 24. The presentation of a week-end case was made by Mr. Frank Boardman, Engineer and Manager of the undertaking. Eulogistic references were made to Mr. Bone's service and his colleagues expressed good wishes, to which Mr. Bone replied, relating many happy incidents in his 12 years' association with Cardiff. Mr. Trevor A. Morgan, Group Accountant, was in the chair.

◇ ◇ ◇

Mr. J. **Macdougall,** Manager at Thrapston, Leicester and Northants Division of the East Midlands Gas Board, has taken over additionally the management of the Oundle undertaking. He succeeds Mr. **W. H. Frost,** who has taken up an appointment with the Leominster District, West Midlands Gas Board. Mr. Macdougall has been at Thrapston for two years, and was previously Assistant Engineer and Manager to his father, Mr. J. Macdougall, who was Engineer and Manager of the Shaftesbury and Stalbridge, Dorset, undertakings prior to nationalisation, and is now Works Superintendent of the Shaftesbury and Gillingham works of the Sherborne and District undertaking, Southern Gas Board.

100 YEARS AGO

Flight of Fancy

It was to be expected that the 38 pages which the July, 1850, issue of the *Journal* devoted to a report of the Great Central Gas Consumers' Bill would contain some gems of verbiage and wit. We particularly like this libellous description of the seasonal variations in the character of London common council members: 'There is something peculiar in the moral constitution—to say nothing of his physique—of a common councilman. If you approach him in spring or summer, you

Line drawing by G. W. Battison

will find him wilful, independent, headstrong; as he would say, firm as a man, or as others would say, obstinate as a mule. Find him in autumn and you will perceive symptoms of yielding, he is more pliant and encouraging. But take him when he is crumbled by the frost of winter, or as the festival of the patron saint comes round, and you will find him accessible and submissive to your heart's content; and then a well directed shot will bring down your common councilman, as early in December as the pheasant or grouse.'

Lord **Adams**, O.B.E., part-time member of the Northern Gas Board, and Mr. **William Hodgson** have been appointed part-time Directors of the Northern (N. & C.) Divisional Coal Board, which administers the coalfields of Northumberland and Cumberland. Lord Adams is Director and General Manager of the West Cumberland Development Company and Secretary of the Cumberland Development Council. Mr. Hodgson is General Secretary of the Newcastle and District Branch of the Typographical Association.

◇ ◇ ◇

Mr. **L. G. Bates**, Sales Manager of the Long Eaton gas undertaking of the East Midlands Gas Board, has been appointed Sales Representative for General Gas Appliances, Ltd., in the areas of the East Midlands and West Midlands Gas Boards. Mr. Bates has succeeded Mr. R. B. Reynolds, and took up his duties on July 1.

◇ ◇ ◇

Presentations were made at the Chesterfield works of the Bryan Donkin Company, Ltd., on June 29, to Mr. **A. G. Webb**, F.C.I.S., Director and Secretary of the Bryan Donkin Company, Ltd., and Secretary of British Furnaces, Ltd., and Mr. **C. W. Crawshaw**, M.I.MECH.E., M.INST.GAS E., London Manager of the two companies, on their retirement after 64½ and 61 years' service respectively. Mr. D. M. Henshaw, Chairman of B.H.D. Engineers, Ltd., the holding company, presided, and the presentations were made by Mr. George Clark, O.B.E., J.P., Director, and until recently Chairman and Managing Director of the two companies. Mr. Clark said that when he came to the Company Mr. Webb was already with them. During his long service he had been consistent and thorough in his work. His duties had been carried out speedily, and he had prepared the accounts in a clear explicit way. He asked him to accept a corner cupboard (from the staff) and a cheque from the Company and wished Mr. Webb and his wife many years of happiness in his retirement. Of Mr. Crawshaw, who received a silver salver and a cheque, Mr. Clark recalled the 'old days' when work started at 6 a.m., and Mr. Crawshaw did two hours of practical work in the shops before slipping off home to breakfast and changing to go into the drawing office. He had, said Mr. Clark, been a loyal and faithful servant to the companies in Chesterfield, Leeds, Manchester, and London. Bouquets were presented to Mrs. Webb and Mrs. Crawshaw by Miss D. A. Chapman, of the London office. Mr. Crawshaw has represented the Bryan Donkin Company on the British Compressed Air Society, of which he was Council Chairman and for many years a member, and the British Valve Manufacturers, where he was a member of the Executive Committee. Mr. F. B. Holmes, Joint Managing Director of W. C. Holmes and Co., Ltd., the associated company, was unavoidably prevented from being present and sent his apologies.

◇ ◇ ◇

WEST MIDLANDS APPOINTMENTS

The following appointments are announced by the West Midlands Gas Board:

N. W. Cole (Superannuation Assistant, Borough Treasurer's Department, West Bromwich) to be Assistant Superannuation Officer, Board headquarters.

P. C. Billings (District Accountant, Cradley Heath) to be District Accountant, Cradley Heath and Halesowen Districts.

H. Willetts (District Inspector, Dudley) to be District Superintendent, Rowley Regis.

H. V. Williams (Shift Superintendent, Wolverhampton) to be Mains Superintendent, Wolverhampton.

H. Taylor (Draughtsman, Windsor Street Works, Birmingham) to be Senior Draughtsman, Windsor Street Works.

J. Bird (Horseley-Piggott, West Bromwich) to be Draughtsman, Windsor Street Works.

V. Hughes (Draughtsman, Stourbridge) to be Senior Draughtsman, Saltley Works, Birmingham.

J. W. Rawbone (Works Manager, Litchurch Works, Derby) to be Deputy Engineer, Foleshill Works, Coventry.

Mr. **J. D. Vaughan**, M.SC., M.I.C.E., M.I.STRUCT.E., has been appointed Chief Engineer and Mr. **J. Sim**, Production Manager, of Horseley Bridge & Thomas Piggott, Ltd., of Tipton.

Diary

July 10-15.—Fourth World Power Conference: London.

July 11.—British Standards Institution: Annual General Meeting, Council Room, 24, Victoria Street, S.W.1. 3 p.m.

July 14.—South Western Gas Consultative Council: Meeting, Taunton, 11 a.m.

July 17.—Eastern Gas Consultative Council: Connaught Rooms, Great Queen Street, W.C.2. 2 p.m.

July 26.—Industrial Gas Development Committee: Gas Industry House, 9.30 a.m.

July 28.—Northern Junior Gas Association: Visit to Expanded Metal Co., Ltd., West Hartlepool.

Sept. 5-7.—Irish Gas Association: Annual Meeting, Limerick.

Sept. 18-22.—Association of Public Lighting Engineers: Annual Meeting and Conference, Bournemouth.

Sept. 20.—Southern Gas Consultative Council: Reading, 2.30 p.m.

1950 'Journal' Directory

The following changes have been notified during the past month. To keep the information of the 1950 edition of the *Gas Journal Calendar and Directory* up to date readers are advised to note these alterations (together with the appropriate adjustments relating thereto in the 'Personnel' section, pp. 135-148a):—

Page 21.—EAST MIDLANDS GAS CONSULTATIVE COUNCIL: Address, Beverley House, University Road, Leicester. T/N 21343/5.

„ 27.—EAST MIDLANDS GAS BOARD: Area Headquarters, Beverley House, University Road, Leicester. T/N 21343/5.

„ 30.—NOTTINGHAM: Add L. W. Jarrett, *E.*

„ 31.—KETTERING: P. T. Harris, *M*, becomes *Group M.*

„ 31.—NORTHAMPTON: R. H. Hutchinson, *E*, becomes *Group M.*

„ 31.—WELLINGBOROUGH: D. A. Foster, *M*, becomes *Group M.*

„ 36.—CHATTERIS: Delete H. Sale, *Dist. M.*

„ 41.—BECCLES: H. Sale, *Dist. M*, vice W. A. G. Hardy.

„ 54.—NORTH THAMES GAS BOARD: Gas Light District. Central Division. Delete F. J. G. Blondin, *Joint Divisional Manager*, retired. A. F. Hetherington becomes *Manager.*
Ascot, Slough, Windsor, Maidenhead, and Wycombe District becomes South Western Division. C. Pearson and P. G. Wright, *Joint Divisional Managers.*

„ 55.—NORTH THAMES GAS BOARD: Beckton becomes Beckton Group. H. Bradley, *Group Engineer* (retaining his position as *Station Engineer*, Beckton Works). Transfer Southend from Group III to Beckton Group. Group II: Transfer Nine Elms from Group III. Group III: E. G. Stewart, *Group Engineer*, vice S. Hay, retired. Transfer Brentford and Southall (but not Staines) from Group IV. Group IV: J. W. Kaye, *Group Engineer*, vice E. G. Stewart. Transfer all stations from Group V to Group IV. Staines remains in Group IV.

„ 74.—METROPOLITAN DIVISION: Delete G. R. Bullwinkle, *Station Engineer*, Vauxhall, retired.

„ 74 and 76.—KENT COUNTY DIVISION: Head Office, 'Pembury End,' Pembury Road, Tunbridge Wells. T/N Tunbridge Wells 3461.

„ 111.—BIRMINGHAM AND DISTRICT DIVISION: Delete E. G. Jeynes, *Divisional Accountant*, retired.

„ 113.—LEDBURY DISTRICT: Delete A. Blakemore, *E & M*, deceased.

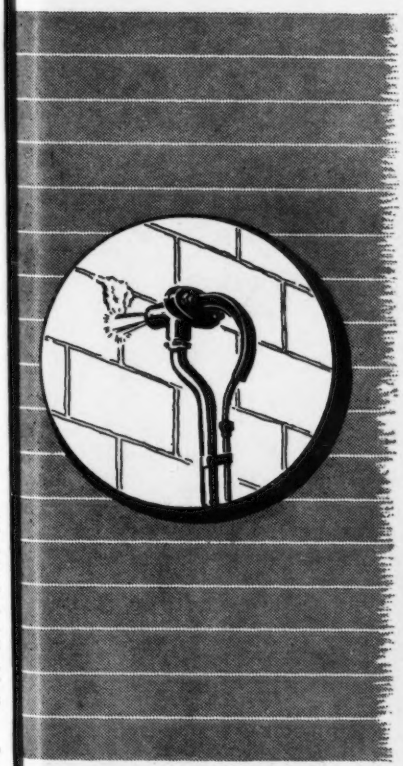
PROLONG THE LIFE OF YOUR GAS MAKING PLANT BY

Spray Welding

Developed from the pioneer work of the Birmingham Gas Department the Spray Welding Process enables the walls of gas making plants to be repaired whilst they are *hot*.

Briefly — a dry powdered refractory material is applied in a fused state by means of an oxy-coal-gas flame to the defective area and there welded to the refractory structure.

Both the extent and the location of the weld are controlled by the operator. Holes can be filled, joints closed and eroded areas built up.



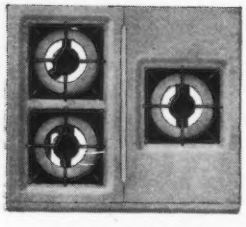
THE WOODALL-DUCKHAM VERTICAL RETORT & OVEN CONSTRUCTION CO. (1920) LTD.
WOODALL-DUCKHAM HOUSE, 63-77 BROMPTON ROAD, LONDON, S.W.3
Members of the Society of British Gas Industries
TELEPHONE: KENsington 6355 (7 lines) TELEGRAMS: RETORTICAL, SOUTHKENS, LONDON

TAS/W-D. 61

Britain's Housewives are saying . .

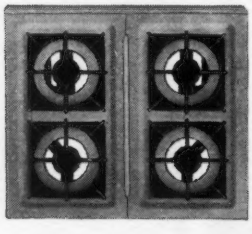
Thousands of Britain's housewives, proud and happy in the possession of a NEW WORLD S.3180 Series Gas Cooker, are saying: "It's a NEW WORLD for me!" Because of its high performance, low maintenance and low initial cost, this latest addition to the NEW WORLD Series is already widely adopted by many Area Boards for long-term Hire Purchase Schemes.
The NEW WORLD S.3180 Series Cookers are of simple construction, specially designed for long, hard use. They have a large oven controlled by a front-reading Regulo. The ovens have rounded interior surfaces for easy cleaning. There is a big, highly efficient grill. The finish is Radar vitreous enamel with the door panel in white vitreous enamel.

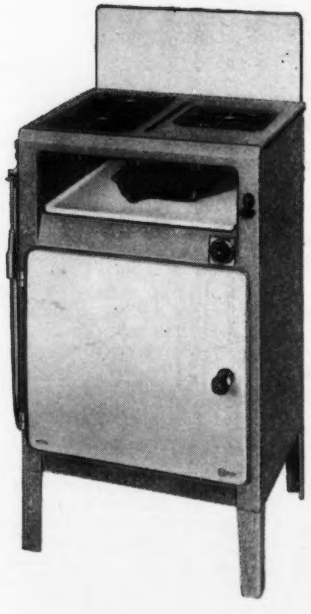
NEW WORLD No. S.3180 SERIES GAS COOKERS WITH REGULO CONTROL



Plan of Hotplate of S.3180 Cooker. The hotplate has one drilled ring burner for rapid boiling and two Rado burners. The hotplate top consists of two Radar enamelled cast iron sections, with black vitreous enamelled pan supports, all removable for easy cleaning.

Plan of Hotplate of S.4180 Cooker. The hotplate differs from the S.3180 by the addition of an extra Rado burner, to give a four boiling burner hotplate.





PRODUCT OF Radiation LTD.

Radiation Group Sales, Ltd., Radiation House, Aston, Birmingham,

NEW WORLD NEW WORLD NEW WORLD

"It's a NEW WORLD for me"

Showrooms & London Offices: 7 & 8 Stratford Place, W.1.

NEW WORLD NEW WORLD NEW WORLD

4138A

Gas to the Rescue

GREAT activity is reported from the Darwen undertaking of the Blackburn Group (North Western Gas Board). Cookery demonstrations were held in the gas showrooms, two sessions daily for four days. All the demonstrations were well attended, many people having to be refused admittance. During the eight demonstrations over 500 people attended.

The demonstrations were of particular importance because they were the official means of announcing a 1s. a week cooker drive and a cake baking competition organised by the undertaking. Variety was the keynote of the demonstrations, which were given by Mrs. L. Cook, Home Service Adviser to the undertaking, assisted by Miss A. Leonard. Interest and enthusiasm were at a high level, reflected in the entries for the cake competition which numbered 203. Local hardware dealers soon exhausted their supplies of 8 in. sandwich tins and were mystified by the popularity of this size until they were informed of the competition.

Attractive Display

All the cakes entered for the competition were on display on the stand organised by the undertaking at the Darwen Agricultural Show. These proved to be a great attraction and more than 8,000 people visited the stand during the day. Interest was shown in the attractive domestic and canteen appliances on show. In the afternoon the prize winners received their prizes from Councillor E. Yates, a member of the West District Committee, North Western Gas Consultative Council, who was introduced by Mr. T. Ashton, Chief Clerk of the Darwen undertaking. Councillor Yates, accompanied by Mrs. Yates, in presenting the prizes, congratulated the undertaking on an attractive display.

The first prize, a gas cooker, was awarded to Mrs. E. M. Waddicor, the second prize, a gas fire to Mrs. J. Holden, and the third prize, a coke grate to Mrs. A. Wilde.

A popular feature of the stand was the Home Service Advice Bureau, with Mrs. Cook and Miss A. Leonard in attendance. Cookery demonstrations were continuous from 10 a.m. until 7 p.m. and attracted large numbers. Over 3,000 copies of the recipes used at these demonstrations were distributed during the day.

First Aid Work

There was no unfavourable connection between the gas stand and the food poisoning episode which occurred at the show in which over 60 people suffered. 'Mr. Therm,' however, as usual, did a good job of work. The first aid section of the St. John Ambulance Brigade had their headquarters near the gas stand and in the upheaval that followed the incident they had to solicit the aid of the gas stand for supplies of water, which had already been laid on by the undertaking for the demonstrations.

When the last casualty had been removed to hospital the first aid workers began to relax but were unable to obtain refreshments due to the refreshment marquees being closed and under the supervision of the Medical Officer of Health, who was investigating the food poisoning incident. Councillor Mrs. Meggitt, who was in charge of the first aid section, approached the gas stand for assistance, which was readily forthcoming. Large quantities of tea were brewed and the dishes cooked during the demonstrations were used to assuage the hunger of the first aid personnel. This action by the Home Service Advisers was much appreciated and a letter of appreciation was forwarded by Councillor Mrs. Meggitt to the undertaking.

The Royal Show

The use of gas and coke on the farm and in the rural home is the theme of the exhibit of the Gas Council at this year's Royal Show at Oxford from July 4-7. This is the first time that the gas industry has staged a national exhibit at England's premier agricultural show.

The variety of uses to which gas can be put on the farm is seen in the wide range of the exhibits, including not merely the normal domestic uses in the home, but also the dairy, the poultry farm, the greenhouse, the barn, and the heated plot. The barn has been fitted with a coke-fired grass drier and baler, and will be working throughout the Show. The poultry exhibit includes gas-heated brooders and incubators, the brooders featuring a supply of day-old chicks. In the dairy can be found gas-heated pasteurisers, sterilising chest, refrigerator, steam and pressure boilers, and a hot water storage set; and the garden plot has been fitted with the latest soil-heating equipment.

Both gas and coke appliances are on view in the greenhouses and in the domestic section, the latter housed in the central pavilion of the Gas Council's exhibit, being based on the plans of a typical rural house. A large number of the exhibits are working.

Compensation Values

The Minister of Fuel and Power has declared by order that the values of the following securities have been determined under Part II of the Gas Act, the conversion date being June 12, on which date the securities were extinguished and the holders became instead holders of British Gas 3% Guaranteed Stock, 1990-95.

Company	Compensation Value
Kinghorn Gas-Light Co. 4% Red. Deb. (£100 unit)	£100
Musselburgh Gas Co. Ord. Shares (£1 unit)	40/–
Tideswell Gas Light and Coke Co. Ord. Shares (£1 unit)	17/6

Research Fellowship

The Institution of Heating and Ventilating Engineers has decided to offer a Research Fellowship of £350 for one year. This is in accordance with the announcement made by the retiring President of the Institution last February when he said that the Council had decided to devote a portion of Research Fund to the collation of data and the preparation of a report or reports suitable for use by the industry. The Fellowship may be increased in amount and duration.

The Fellow will normally work at the National College for Heating, Ventilating, Refrigeration, and Fan Engineering, Borough Road, London, S.E.1, but he will be expected to visit other institutions with similar interests. The appointment has not yet been made.

Rating of Gas Undertakings

As from February 1, 1950, various changes in procedure relating to rating assessments came into operation under the Local Government Act, 1948. The Inland Revenue assumed responsibility for rating assessments, although the rating authorities continued to be the collecting authorities.

Previously it had been permissible for a rating authority or a ratepayer to make a proposal for a variation of the current valuation list on the general grounds that the existing assessment was incorrect or unfair, provided such proposals gave an indication as to whether an increase or decrease in the assessment was intended. It was not essential that they should state the precise amount in figures to which it was suggested the current rateable value should be altered.

After February 1 it was generally assumed that protective proposals were no longer valid and that it was necessary that proposals should state in figures the amount to which the assessment should be altered.

The Inland Revenue and many gas boards desired to make proposals with regard to the rate for the period 1949-50, and in order that such proposals should date back to the beginning of the rate, i.e., April 1, 1949, it was necessary that they should be made before April 1, 1950.

The Inland Revenue were prepared to waive the strict interpretation of the law and to accept 'protective proposals' in respect of this period but, owing to the lack of time for adequate consultation, a similar undertaking was not obtained from the associations of the rating authorities.

It was therefore agreed that proposals should be made containing notional figures, which were admittedly not the result of a considered valuation. Notional figures were only utilised to overcome the technicality referred to which would otherwise have precluded the Inland Revenue and the gas boards from obtaining any revision of the rate operative for the period 1949-50.

Manufacture of Refractory Materials

Manchester Juniors Visit Derbyshire Works

THE Ladies' Day for the 1949-50 Session of the Manchester District Junior Association of Gas Engineers was held under the kind auspices of the Derbyshire Silica Firebrick Co., Ltd., when about 150 members and their ladies were received and welcomed at the Friden works of the Company, on June 14, by Mr. Frank West, Chairman of the Board. The party, which was under the leadership of the President, Mr. R. J. Bradshaw (St. Helens) was conveyed by motor 'buses from Manchester to the works, which are situated some 11 miles from Buxton.

Towards the end of the nineteenth century the founder of the Company, Mr. John West, foresaw that industrial processes using high temperatures would tend to operate at higher and increasingly higher temperatures. He therefore began to search for raw materials from which refractories capable of withstanding such temperatures could be made, and the Derbyshire pocket silicas came to his notice. In 1892 the firm was established in order to work these materials which, since then, have been used extensively in the gas industry, the steel industry, and others which operate high-temperature industrial furnaces.

Visitors to Haddon Hall. Left to right: Mrs. D. M. Thompson, D. M. Thompson (Senior Vice-President, Manchester Juniors), Mrs. R. J. Bradshaw, J. S. F. Beale (Managing Director, Derbyshire Silica and Firebrick Co., Ltd.), Mrs. N. L. Lloyd, and R. J. Bradshaw (President, Manchester Juniors).

Insulating Products

The three main products manufactured by the firm are siliceous and semi-siliceous materials containing 82% to 92% silica, 'Dome' diatomaceous insulating and 'Peaksil' 95% silico materials, as well as supplementary products including various jointing cements.

The processes used in the manufacture of siliceous products were inspected, the main ingredients of which are the Derbyshire pocket silicas. The next production unit to be seen was that for the manufacture of 'Dome' insulating products from diatomaceous earth obtained from Northern Ireland, thus making the products wholly British. 'Peaksil' silica products are made from ganister or silica rock.

The siliceous sands and clay known as Derbyshire pocket silicas are contained within carboniferous limestone, and it was explained that their origin still confounds the geologists. These sands and clays are won mostly by mechanical means from a number of pits all of which are within three or four miles of the works, and are transported for preparation either by diesel locos and jubilee wagons running on a narrow gauge railway, or by road lorries. At the working faces sands and clays are classified according to type and quality, and then conveyed to the works where controlled blending and mixing takes place.

Ganister, which occurs in the coal measures, is the main material used for the manufacture of 'Peaksil' products, and is won both from open pits and from mines. It occurs in an area east of Matlock, and is transported to the works by motor lorry.

The works themselves are situated in the High Peak of Derbyshire. The works site occupies seven acres out of the total of 800 acres which comprise the firm's estate, the remainder consisting of siliceous sand and clay pits and farmlands.

The equipment used and the method of manufacture for each of the various types of refractory products made are separate and distinct from each other. In the making of siliceous products the raw materials are blended and screened, after which they are conveyed to storage bins. From the bins the raw materials go either to the pugs and from there to the presses, for the manufacture of special shapes, or directly to presses for the manufacture of standards of various sizes, though certain special shapes cannot be moulded by machine and have to be hand-moulded.

All the materials are dried on hollow floors which are mostly heated by waste steam from the prime movers, and after a day or two the bricks are taken to the kilns for 'setting' into stacks for burning. One range of kilns is continuous in operation, while the others are semi-continuous. Siliceous bricks take approximately four days to heat up, which is achieved by utilising heat in the combustion gases from those kilns which are actually being coal-fired. Then for about a day and a half coal is fed into the chamber, until maximum heat is attained, and this is held steady for a specified period. From this point bricks are cooled down for about 11 days. The total schedule occupies approximately 16½ days.

Kiln turn around time is about 22 days for siliceous materials, since in addition there must be included time for 'setting' and 'drawing' of kiln contents as well as for kiln cleaning and minor repairs. In the case of 'Peaksil' materials, due to the higher temperature of firing and the longer soaking period of maximum temperature, the turn around schedule is extended to about 30 days.

Kilns are heated and cooled to a closely controlled schedule according to the type of material to be fired. The burning process is perhaps the most important through which the brick has to pass, and great care is taken that nothing is left to chance. From the very first, careful control is maintained by the use of automatic temperature recorders, optical pyrometers, and Segar cones. All optical readings are recorded. This care ensures a finished product of as good a shape, as nearly true to size, and as free from cracks as is humanly possible.

'Peaksil' products are prepared from raw materials in plant quite separate from that used for the siliceous materials. In this process, ganister or silica rock is ground in an enclosed mill together with the lime bonding agent, &c., and is fed to bins adjacent to the presses. During pressing of special shapes uniformity of weight is established by direct weighing of material for each block. After floor drying the material is set in kilns where it is given a longer 'soaking' at a higher maximum heat than is given to siliceous goods in order to promote the maximum degree of conversion.

The manufacture of 'Dome' insulating materials is again quite different from that of normal refractories. The raw materials for this process consist of diatomaceous earth and a light-weight combustible. These two ingredients are mixed and pugged, then automatically cut into bricks and dried on 'cages' in a tunnel drier which is heated by kiln waste gases and thermostatically controlled steam radiators. Since the mixture contains a 'burn-out' material these products are fired to a totally different schedule from anything else that

(*Continued at foot of p. 46*)

Black Cookers Scrapped

During the past 12 months more than 12,000 obsolete black cookers in use in the Manchester area have been taken out of gas consumers' homes and replaced by the North Western Gas Board with cookers of modern design as a result of a big sales drive carried out by the Manchester undertaking.

A section of a batch of 7,000 black cookers now lying at the Gleden Street Depot of the Manchester gas undertaking awaiting disposal as scrap.

When the board took over the gas industry of the North West there were upwards of 100,000 black cookers in use in the Manchester area alone. It has been the policy of the board to replace these throughout its territory with modern cookers, finished in enamel and fitted with thermostatic controls, which will give a more economical and satisfactory service to consumers.

REFRACTORY MATERIALS — Continued from p. 45

the firm manufactures. The maximum temperature is much lower, and the overall schedule is much shorter.

Some fireclay goods are also produced by the firm, the method used being very similar to that of the siliceous products, but the raw material is not found locally. In addition, sillimanite refractories are manufactured. Some of the blocks made for the glass industry are very large and weigh as much as 800 lb. They are moulded by tamping with pneumatic hammers, and must be dried very slowly in order to minimise the risk of cracking.

Where a very close tolerance is required bricks are ground to size. Silica shapes, also, are ground to size when necessary.

A most important function of the technical department is its development work which provides a very significant guide to progress and a link with the future. The work of the technical department, and particularly the research work it does, is of the greatest importance not only to the Company, but also to the industries to which products are supplied.

The output of the plant is approximately two hundred thousand equivalent 9 in. by 4½ in. by 3 in. squares per week, plus the necessary cements required for setting them.

'Durosil,' another of the firm's products, provides a furnace lining of the highest refractory quality, eliminating joints, and being highly resistant to slagging and abrasion.

During the course of the day the party were entertained at luncheon and subsequently paid a visit to Haddon Hall, a famous mansion, and one of the most attractive of the ancient manorial dwellings of England.

On returning to the Friden works tea was served in the works canteen.

Mr. **Frank West,** Chairman of the Company, expressed the hope of his Directors and himself that the visitors had had a thoroughly enjoyable day. Mr. West mentioned that when the Association took an official shape in November, 1898, he came in contact with Mr. E. J. Wellens, the then Secretary, and, as the result of his experience in Nottingham, he read a paper on 'Purification.' The present was the second visit of the Association, the first being in 1922. Mr. George Dixon, who was at Lancaster at that time, was the President and Mr. J. Alsop the Secretary.

Mr. **H. V. Dann** (Blackburn) moved a vote of thanks to Mr. West and his co-Directors for their hospitality.

Mr. **E. Kenyon** (Middleton), in seconding, mentioned that he was present at the visit in 1922 referred to by Mr. West.

Mr. **N. L. Lloyd** (Works Manager, Derbyshire Silica Firebrick Co., Ltd.) responded to a vote of thanks on behalf of the guides.

The **President** mentioned that Mr. John Irminger, of Bergen, was present, and asked him to say a few words to the members.

Mr. **John Irminger** said that wherever he had travelled throughout the world in connection with the affairs of the gas industry he had always learned that the materials produced at the Friden works were regarded as being of the highest possible quality. During the course of that day's visit he had been most favourably impressed by the great care which was taken in the preparation of the various products and in the research work undertaken in the laboratory in order further to improve the quality of the materials produced.

North Western Aims

Greater productivity per £ spent is the central aim of the organisation set up by the North Western Gas Board which groups the 103 gas undertakings of the North West into 17 teams each under a general manager, according to *Link-up*, the board's news magazine.

'This economic aim the board seeks to achieve,' states the magazine, 'by cutting out overlapping duties and expense, improving and tuning up plant where this is necessary, and using existing plant to secure best economic balance.'

Other measures mentioned include the introduction of mechanised accounting systems when these are economically justified, and streamlining the flow of coal to and coke from the gasworks. Envisaged also is the eventual adoption within each group of undertakings of uniform quality and prices for gas coke and appliances.

Physical integration of undertakings in self-reinforcing gas grids is mentioned as a possibility in certain groups of undertakings but it is emphasised that such link-ups will only be carried out when detailed surveys show that worthwhile economies can be obtained.

Windermere Meeting

The Spring Meeting of the Cumberland and Westmorland Gas Managers' Association was held at Windermere on June 22, under the presidency of Mr. A. G. Arnott, Manager, Aspatria undertaking, Northern Gas Board.

The following were elected to office for the year 1950-51 : President, Mr. R. Osmotherley, Dalton-in-Furness; Vice-President, Mr. A. Field, Penrith; Secretary, Mr. W. B. Hetherington, Keswick.

Mr. A. L. Robertson, Wigton, who retired recently after over 50 years' service in the gas industry, was elected an Honorary Member of the Association.

After formal business members were shown over the Windermere gasworks under the guidance of Mr. G. R. Spence, Engineer and Manager, and were able to see the preliminary work in progress for the extension of the vertical retort plant and the work of laying the new trunk gas main to Ambleside.

Through the kindness of the North Western Gas Board, a tea was provided at the Albert Hotel, Bowness-on-Windermere, the party being joined by the several ladies who had accompanied their husbands to the meeting.

The President asked Mr. Spence to convey to his board the thanks of the Association for the hospitality shown to them and also thanked Mr. Spence for so largely contributing to the enjoyable meeting

Developments in the Perth Area

Sir Edgar Sylvester Inaugurates Bulk Supply to Coupar Angus

Friarton Gasworks, Perth, by the River Tay.

SIR EDGAR SYLVESTER and Colonel H. C. Smith recently spent two days at Perth as guests of the Chairman and Members of the Scottish Gas Board. On Monday, June 19, they were entertained at luncheon at the Station Hotel, when divisional controllers and group managers from the East of Scotland were present. In the afternoon, the party visited the Friarton gasworks, Perth, and after being introduced to members of the staff and workmen, they were shown round the manufacturing plant and distribution stores and workshops by Mr. Nicol Baird, Group Manager of the Perth Group. They inspected the modern condensing, ammonia washing, electrostatic detarring and purifying plant which has recently been installed at these works, and were able to see the site where work is due to commence during the next two or three weeks in connection with the installation of a new automatically-operated carburetted water gas plant and an extension of the vertical retort house. They also inspected the extensions to office premises which are now in hand, to provide additional accommodation required in connection with group administrative work.

On Tuesday, June 20, Sir Edgar visited the Coupar Angus gasworks, some 13 miles from Perth, and opened the valve which brought into operation the first of several integration schemes planned for this area. Soon after nationalisation, it was discovered that the Coupar Angus gas undertaking was in a desperate plight. The manufacturing plant was obsolete and quite unable to cope with the gas requirements of the Burgh. To have reconstructed the plant would have been uneconomic. The nearby undertaking at Blairgowrie was also found to be requiring additional plant at an estimated cost of approximately £20,000. In order to safeguard supplies there, the Scottish Gas Board decided on a long term policy of laying a bulk supply main from Perth, where gas can be produced very much more efficiently, so enabling the manufacturing plant at Coupar Angus and Blairgowrie to be closed down. Although authorisation from the Ministry of Fuel and Power was not received until October, 1949, over 11 miles of 10 in. diameter pipeline and 4¼ miles of 8 in. diameter pipline have now been laid. Ultimately, volumetric governors with remote control apparatus are to be installed, thus enabling the district holder station at Coupar Angus and Blairgowrie to be controlled from Perth by voice frequency signalling through telephone wires rented from the Post Office. In the meantime, however, until this apparatus is delivered, the system is being controlled manually. Spun iron pipes with screwed gland joints have been used throughout and the whole of the pipeline has been tested to 30 lb. per sq. in. air pressure. The rapid rate of mainlaying, which was consistently maintained throughout the winter months, was made possible only through the use of mechanical excavators and trenching machines.

Mr. Nicol Baird, Group Manager, and members of the staff and employees of the undertaking, who have been engaged on the scheme, feel justifiably proud of their achievement. Great credit is due to the contractors—the Dreit Construction Company, Ltd., of Perth—who carried out the whole of the civil engineering work apart from jointing and testing. The total cost of the scheme is estimated to be nearly £90,000, of which some £60,000 has already been spent. Village dwellers at Balbeggie, Burrelton, Woodside, and Rosemount, as well as isolated cottages and farms en route, will now be able to enjoy a supply of gas for the first time from the bulk supply pipeline, which has a capacity far in excess of the present demands at Coupar Angus and Blairgowrie, and will be available for extension to other areas whenever the necessity arises.

By a coincidence, the scheme is in accordance with the recommendations of Mr. Gordon Payne, a consulting architect, who produced a planning report for East Central Scotland Area, wherein he envisaged the linking-up of gas undertakings within the Strathmore Valley as a means of bringing to rural districts the amenities of a gas supply normally available only to towns and cities.

Later in the day the party visited the gasworks at Blairgowrie, Dunkeld, Pitlochry, Aberfeldy, and Crieff. The Perth Group, although only one of the 11 administrative areas of the Scottish Gas Board, embraces 17 undertakings and covers a territory of approximately 2,600 square miles. The total number of consumers is over 50,000, and these are more or less concentrated in an area of 1,200 square miles. In addition to the Coupar Angus-Blairgowrie project, the undertaking at Dollar has recently been integrated with Alloa, the second largest undertaking in the Group, by three miles of 6 in. diameter pipeline. Two further integration schemes have been authorised, and

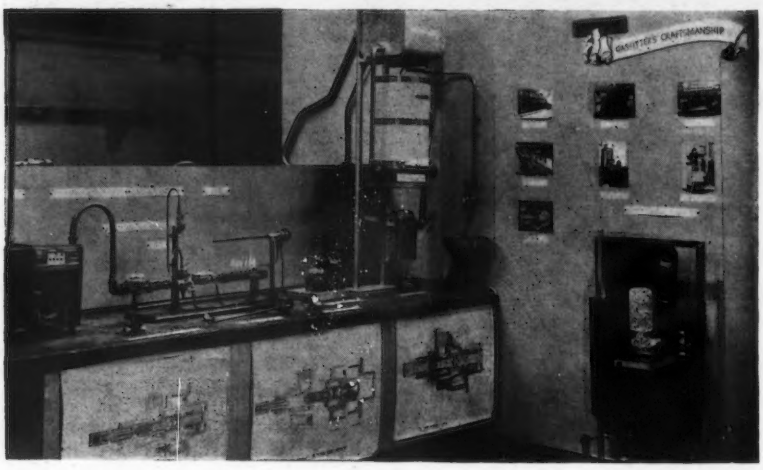
(*Continued at foot of p. 48*)

Sir Edgar Sylvester opens the valve at Coupar Angus gasworks and inaugurates the new bulk supply scheme from Perth. Left to right: D. D. Melvin (Member, Scottish Gas Board), D. D. Burns (Deputy Chairman, Scottish Gas Board), Nicol Baird (Group Manager, Perth), Sir Andrew Clow (Chairman, Scottish Gas Board), and Colonel H. C. Smith (Deputy Chairman, Gas Council).

WAKEFIELD CAREERS EXHIBITION

The Rotary Club of Wakefield sponsored a successful Careers Exhibition during the first week of June at the Technical and Arts College, Wakefield. Some 100 trades and professions were represented, and most trades gave practical exhibitions of the processes involved in the manufacture and fabrication of their particular product, while the professions had fully trained personnel in attendance in their bureaux throughout the exhibition.

The Wakefield Group of the North Eastern Gas Board provided a pleasing display in the main entrance hall in addition to a fully tooled workshop in which



a Grade 1 gas fitter and a gas fitter's apprentice carried out actual fitting and appliance maintenance, while in the film theatre the story was being told through the medium of the Gas Council's film publications. The remainder of the site allocated to the gas industry was usefully employed by a scale model of the Bradford (Birkshall Lane) works, sectioned models of appliances and fittings, working models of thermostats, Perspex governors, refrigerator unit, and a miniature working model of a domestic hot water system with circulator and economy valve.

Officials of the Group were in attendance to advise parents and youths on the opportunities for careers in the industry.

The exhibition was a pronounced success, and was attended by 17,200 visitors.

PERTH AREA — continued from p. 47

others are being planned. There are, however, several isolated units which, owing to their distance from larger centres, must continue as manufacturing units. Modern retort settings are being installed at these works to ensure a satisfactory supply of gas, together with the utmost fuel economy.

In the evening a dinner was held at the Station Hotel, Perth, and in his speech, Sir Edgar Sylvester stressed the importance of competition between what he referred to as the sister industries of gas and electricity.

On June 20 Sir Edgar Sylvester and Colonel Smith visited the stand of the Paisley undertaking at the Royal Highland and Agricultural Show. They were accompanied by Sir Andrew Clow, Mr. D. D. Burns and Mr. David Fulton. The party were escorted by Mr. Dow, District Manager at Paisley. The display included a refrigerator, kitchen cabinet, cooker, and all-steel kitchen sink, suitable for farm kitchen purposes, and a water heater. Also on view were sterilising equipment for dairies, brooders, incubators, steam-raising equipment, with coke-burning appliances, domestic boilers, gas rings and pokers, and a display of gas by-products.

Midland Juniors Ladies' Day

The Midland Junior Gas Association held its annual Ladies' Day at Worcester on June 15. Some 80 members and their ladies were entertained to luncheon at the Star Hotel by the Worcestershire and Herefordshire Division of the West Midlands Gas Board.

Mr. C. F. W. Rendle, O.B.E., Divisional Manager, in a short speech, welcomed the members of the Association to Worcester and said he was glad that the Ladies' Day had been held there.

Mr. S. C. Bentley, President, replied and thanked the West Midlands Gas Board (Worcs. and Hereford Division) for their welcome and hospitality, and Mr. Rendle for the part he had taken in making the visit possible. Mr. Rendle was President of the Association in 1922-23 and since then had continued to take an active interest in the Juniors.

The toast of 'The Ladies' was proposed by Mr. H. J. Reynolds, Hon. Secretary of the Association, and Mrs. S C. Bentley responded.

During the afternoon the works of the Metal Box Co., Ltd. Perry Wood Factory, Worcester, was visited. First the ladies were grouped into small parties and taken round the works by lady guides and then the members themselves were treated likewise with men as their guides. The manufacture, testing, and packing of 'tin cans' was seen and proved to be of great interest to all in what must be one of the most up-to-date plants of its kind in the country.

The President thanked Mr. Tyler, Manager, for the instructive and interesting afternoon and asked him to thank the Directors for their permission to visit the works and all the guides for the excellent way they conducted their parties through the works and explained the intricate processes.

Tea was taken at the Deansway Restaurant, and afterwards a short trip on the River Severn to Camp Lock and back was arranged.

West Midlands Gas Prices

Mr. G. le B. Diamond, Chairman of the West Midlands Gas Board, told the West Midlands Gas Consultative Council on June 26 that as a result of outside circumstances over which the board had no control, additional costs amounting to about £700,000 per annum would have to be met if income was to balance expenditure. Consequently gas prices would have to be increased in the near future.

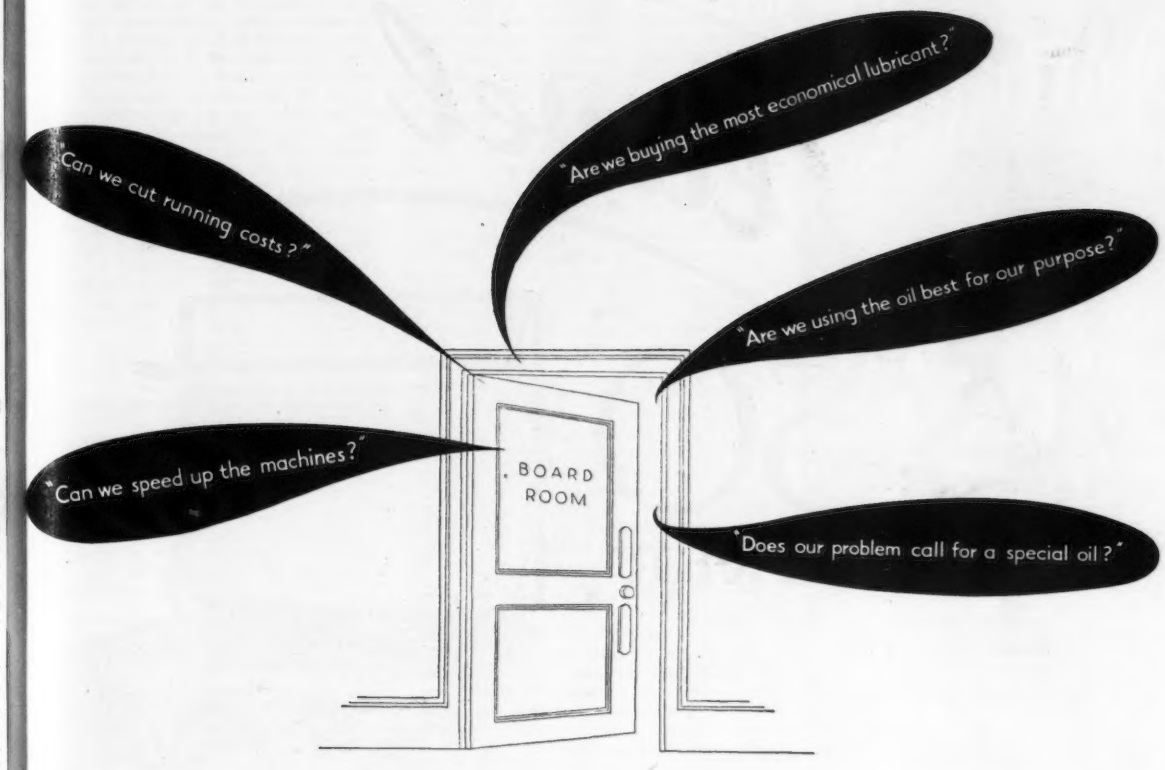
The increases since the last revision of gas prices comprised additional railway freight charges, wages award, increase in the cost of gas oil consequent upon devaluation, increase in petrol prices, increased haulage costs, additional interest charges and other items.

Mr. Diamond gave examples of improved working results which had accounted for a saving of approximately £92,000 per annum, but he said that the higher efficiency already obtained had been heavily outweighed by these further increased commitments.

Earlier in the meeting, presided over by Mr. W. H. Malcolm, it was stated that a letter had been received from the Urban District Councils' Association suggesting results of gas tests should be published. The board was stated to be carrying out its obligations by displaying such information in gas showrooms and elsewhere, the information being available to anyone who made a request for it.

A request was made from a Labour organisation for copies of minutes and other matter circulated by the council. The Chairman said he had written to the Ministry to find out what should be done quite irrespective of party, and after a long time they wrote that it was a matter for the council to decide. It was thought that as much information as possible should be published provided it was not confidential.

Discussion ensued on the advisability of furnishing copies of minutes which, it was felt, might be misinterpreted by those not familiar with the surrounding circumstances. It was left to the Chairman to get in touch with the applicants and give them high-lights of information but not the actual minutes.


"Can we cut running costs?"
"Are we buying the most economical lubricant?"
"Are we using the oil best for our purpose?"
"Can we speed up the machines?"
BOARD ROOM
"Does our problem call for a special oil?"

For the answer to these, and to *all* other oil problems, consult the

WAKEFIELD INDUSTRIAL LUBRICATION SERVICE

From their experience in solving the problems of many of the largest oil users in industry, the engineers of the Wakefield Industrial Lubrication Service can certainly answer any questions you may have concerning lubrication. The Service is always at your disposal, and a request will bring you a technician qualified to analyse the whole of your problem and to offer constructive advice.

OIL FOR INDUSTRY

C. C. WAKEFIELD AND COMPANY LIMITED · LONDON · W.1

The Flavel 45-50 GAS COOKER

SINGLE ACTION FOLDING PLATE-RACK and COVER TOP or
FIXED SPLASHBACK and LIFT-UP RACK
(or short splashplate only).

●

TWO-PIECE CAST IRON HOTPLATE. With 3 or 4 boiling burners. New super-speed COIL burners at front. Medium and simmering burners at back. Extra-fast grill. Aluminium grill pan. Loose crown plate. Safety taps with bakelite thumb pieces.

THERMOTAP combined oven tap and heat control, or THERMOSTAT and separate oven tap.

●

SMOOTHLINE OVEN of even heat distribution and high stability. Choice of aerated or neat-flame burners. Two grid shelves, meat tin and cake tray.

The 45-50 is provided with a governor to ensure constant gas pressure. Levelling screws fitted to legs.

●

VITREOUS ENAMEL FINISHES.

Pearl grey mottle and white.
Green and cream.
All white.

All models have black vitreous enamel hotplates.

FLAVELS of LEAMINGTON
Established in the year 1777

Imperial Continental Gas Association

INFORMATION concerning the operations of companies in which the Association is interested are included in the annual report of the Imperial Continental Gas Association, whose financial results have already been published in the *Journal* (May 24, p. 523). The report says that the settlement of the Association's claim against the French Government for compensation following the expropriation of the Association's properties under the Nationalisation Law, 1946, has been unexpectedly delayed. This was due to the institution of French claims against the British Government in respect of French interests in British nationalised industries. In addition to the interests already acquired in Ewart & Son, Ltd., and James Stott & Co. (Engineers), Ltd., the Association has acquired the entire share capital of British Sewing Machines, Ltd.

Increased Profits

The profit available for the year ended December 31, 1949, for the Antwerp undertaking amounted to Frs. 23,200,000, after providing Frs. 20,749,300 for depreciation and Frs. 1,254,000 for legal reserve. The dividend for 1949 was at the rate of Frs. 72.50 per share against Frs. 62.50 for the previous year. Sales of gas showed a small increase during the year. New mains were laid to the extent of 9.309 metres (5.8 miles).

After providing Frs. 10,467,096 for depreciation and Frs. 2,636,842 for legal reserve, the profit distributed as dividend for the year ended December 31, 1949, in respect of the Brussels undertaking, amounted to Frs. 30,562,500. This sum allowed a payment of dividend for 1949 at the rate of Frs. 62.50 per share, compared with Frs. 55 per share for the previous year. Sales of gas and electricity showed slight decreases during the year. New gas mains and electricity cables were laid for lengths of 1,118 metres (0.7 miles) for gas and 6,270 metres (3.9 miles) for electricity.

The Provinciale undertaking paid a dividend for 1949 at the rate of Frs. 60 per share, compared with Frs. 45 per share for the previous year. The dividend required Frs. 42,480,000, after providing Frs. 37,333,076 for depreciation and allocating Frs. 2,400,000 to legal reserve. Sales of gas and electricity rose by 3.09% and 1.23% respectively. The number of consumers increased by 3,836 for gas and 2,085 for electricity. New gas mains and electricity cables were laid for lengths of 37,952 metres (23.6 miles) and 32,954 metres (20.3 miles). The laying of a new gas main linking the Gembloux works to the commune of Court-Saint-Etienne (south east of Brussels) was completed, and the erection of the new 3½ mill. cu.ft. gasholder at Woluwe-Saint-Lambert was continued. At Zavantem (north east of Brussels) the conversion of the electricity network to alternating current was completed.

The higher profits of these three undertakings are attributed to increases in the prices of gas and electricity authorised by the Belgian Government during 1949.

Due to the continued fall in the selling price of metallurgical coke, the operations of Les Cokeries du Brabant resulted in a heavy loss. After providing Frs. 6,174,113 for depreciation, the loss for the year was Frs. 35,511,499 (equivalent to £253,654). The fall in the price of coke to the level offered by the Ruhr coke oven undertakings has not been followed by a corresponding drop in the price of Belgian coal. During the year there was a slight improvement as a result of a reduction of Frs. 80 per ton in the maximum price of coking smalls and of an increase in the price at which coke oven undertakings were allowed to sell their gas. A decision of the Belgian Government cancelling an order by which coke oven undertakings were obliged to sell their coke through a single selling organisation enabled the Company to dispose of coke stocks which had reached 90,000 tons early in the year. These measures only diminished the loss and the Company was obliged to close more than half its producing capacity.

After placing Frs. 20,749,300 to reserve, including certain capital profits, the Compagnie Belge et Continentale de Gaz et d'Electricité (Contibel), which is responsible for financing Les Cokeries du Brabant, decided to pay no dividend in view of the heavy losses of the latter Company.

During the year ended April 30, 1949, the consumption of gas and electricity in the area of supply of the Compagnie Nationale d'Eclairage decreased by 11.52% and 6.12% respectively. After providing Frs. 1,458,323 for depreciation and Frs. 81,952 for legal reserve, the Company paid a dividend of Frs. 1,500,000 at the rate of Frs. 5 per Preferred share and Frs. 10 per Ordinary share, the same as for the previous year.

For the year ended March 31, 1949, Belcomin made a profit of Frs. 1,952,286 which was carried to reserve.

After providing Frs. 3,945,622 for depreciation and Frs. 151,700 for legal reserve, the Compagnie Continentale d'Appareils de Mesure (Contimeter) paid a dividend for the year ended Mar. 31, 1949, at the rate of Frs. 280 per share, compared with Frs. 250 for the previous year. The total amount of the dividend was Frs. 2,704,800. Output was expanded to meet a substantial increase in orders.

The Union Intercommunale des Centrales Electriques de Brabant (Interbrabant) paid a dividend for 1949 totalling Frs. 62,202,858 at the rate of Frs. 87.86 per capital share and Frs. 151.71 per Ordinary share, compared with the same rate and Frs. 151.14 respectively for the previous year. Satisfactory progress was made with extensions at the Company's two power stations, and last autumn the Company began to supply current for the newly electrified railway line between Brussels and Charleroi.

The Société de Distribution du Gaz (Distrigaz) distributed Frs. 19,285,710 as dividend for 1949 at the rate of Frs. 257.14 per share, compared with Frs. 228.57 per share for the previous year. Frs. 15,396,292 were allocated to depreciation and Frs. 1,103,525 for legal reserve. The Company is taking a leading part in the study of collection, reforming and distribution of methane from Belgian collieries. One contract has already been made for the purchase of this gas and another for transporting the gas from a colliery to a coke oven plant.

After allocating Frs. 4,161,762 to depreciation and Frs. 97,470 to legal reserve, the Société Chimique de Selzaete paid a dividend for 1949 at the rate of Frs. 30 per share, compared with Frs. 25 for the previous year. The total amount of the dividend was Frs. 1,830,000. The results were affected by a fall in prices of by-products. The turnover of Materiel et Appareillage pour le Gaz, l'Electricité et le Coke (Magec) showed a substantial increase during the year.

Permac
METAL-TO-METAL JOINTING MATERIAL

Ever since 1913 "PERMAC," the original Metal-to-Metal jointing, has been holding up difficult joints in Gas Works and on Coke Oven Plants all over the world. Equally suitable for any joint—steam, water, gas, oil, benzol, ammonia, etc.—screw pipe or flange.

Manufactured only by

THOMAS & BISHOP LTD.
39, ARTHUR ROAD, LONDON, S.W.19

SERVICE

FOR THE GAS INDUSTRY

MANOX BRITISH

HARDMAN & HOLDEN LIMITED

INCORPORATING MANCHESTER OXIDE CO LTD

MANOX HOUSE · MILES PLATTING · MANCHESTER · 10

TELEPHONES: COLLYHURST 1551 (11 LINES) • TELEGRAMS: OXIDE MANCHESTER

Peebles & CO. LTD.

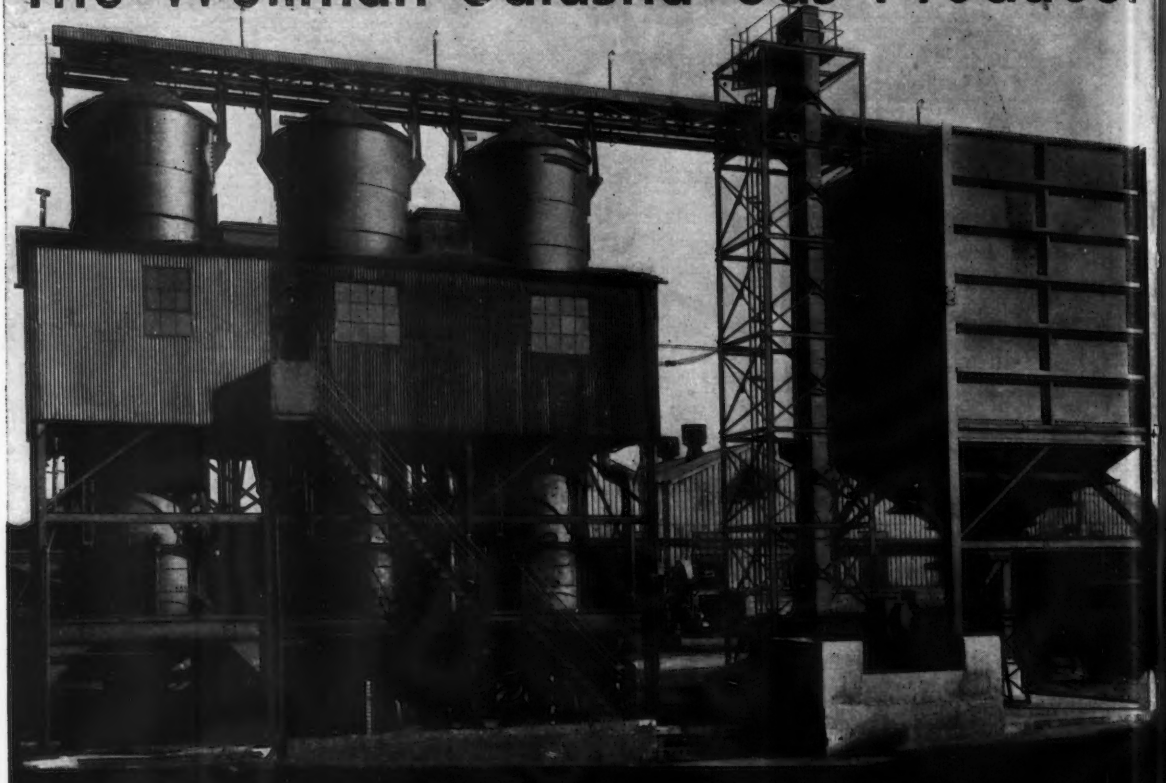
THE FIGURE 109

Diaphragm District Governor is of robust construction and is designed to minimise frictional resistance. Technical data and full description on application.

WEST BOWLING GREEN STREET,
BONNINGTON, EDINBURGH, 6.

Telephones: 36544 & 35069. Telegrams: "TANGENT, EDINBURGH."

The Wellman-Galusha Gas Producer



4% CO_2 from Bituminous Fuels

Wellman-Galusha Gas is an ideal gas for industrial purposes due to its cleanliness, uniformity and dependability.

Below are typical readings from a 10' 0" diameter Wellman-Galusha Gas Producer when gasifying bituminous fuel.

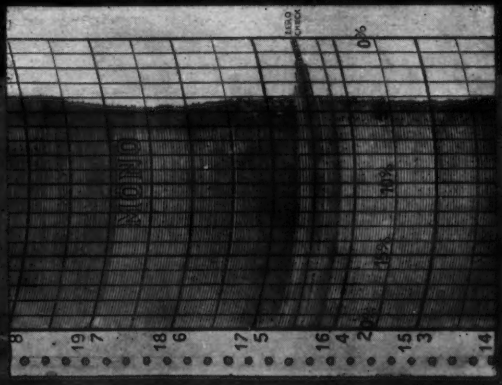
GAS ANALYSIS (typical values)

CO_2	4.2%
O_2	0.4%
CO	27.2%
CH_4	2.7%
H_2	14.3%
N_2	51.2% (by difference)

FUEL

Fuel—Bituminous Coal—Washed Nuts.
C.V.—159.2BTU/ft³ at 30", 60°F Satd. Gross.

SECTION CO_2 CHART



Wellman-Galusha Gas Producers can be supplied in three sizes, namely 6 ft., 8 ft. and 10 ft. diameters — equipped with agitator as desired.

We cordially invite you to write for our brochure entitled "The Wellman-Galusha Gas Producer".

THE WELLMAN SMITH OWEN ENGINEERING CORPN. LTD.
PARNELL HOUSE, WILTON ROAD, LONDON, S.W.1 WORKS: DARLASTON, SOUTH STAFFS.

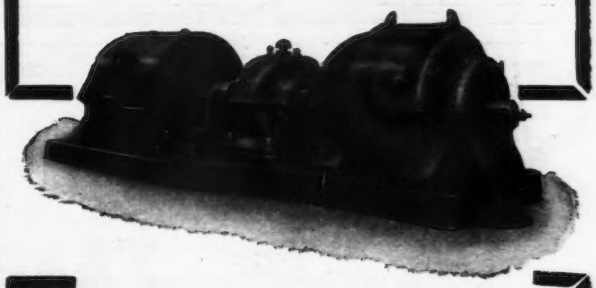
EWART CHAINBELT CO., LTD.
DERBY, ENGLAND
Driving and Conveyor Chains of the best quality; made of Ley's Celebrated Blackheart Malleable Iron.
ALSO COMPLETE CONVEYORS AND ELEVATORS

CASES FOR BINDING
Quarterly Volumes of the "Gas Journal."
5/- each, post free
Walter King, Ltd., 11, Bolt Court, Fleet Street, London, E.C.4.

Foliac
GRAPHITE PRODUCTS LTD.
LONDON, S.W.11.

THOMAS BUGDEN & CO.
India-Rubber and Airproof Manufacturers and General Contractors.
LARGEST MANUFACTURERS OF GAS MAIN BAGS.
Telegrams—"AIRPROOF, BARB, LONDON." Telephone—6147 CLERKENWELL
Contractors to H.M. Government
Gas Bags for Repairing Mains
PATENTEES OF THE DENMAR BAG
Impervious to Main Liquor and Climatic Influences.
Round or Cylinder Shape.
Pull-through and Expanding MAIN STOPPERS.
All types of INDIA-RUBBER BOOTS.
DRAIN RODS AND WHALE-BONE BRUSHES.
HOSE AND TUBING FOR ALL PURPOSES.
Stokers' Mitts and Gloves of every description.
Contractors' & Miners' Woollen Jackets, Trousers, Hats, &c.
244, Coswell Road, LONDON, E.C.1

E·E JEAVONS E. CO-LTD.
TIPTON • STAFFS
CONTRACTORS FOR GAS
MAINLAYING
'Phone: TIPTON 2161 'Grams: "PIPELINES" (5 lines).

TURBO-COMPRESSORS & EXHAUSTERS FOR AIR AND GAS.
* * *
We build a complete range of Compressors & Exhausters for air and GAS, suitable for all purposes connected with the GAS Industry, including Turbo-Compressors for large capacities, as illustrated below.

WRITE FOR PAMPHLET No. 1018 GIVING PARTICULARS—
REAVELL & CO., LTD.,
RANELAGH WORKS, IPSWICH.
Telegrams: REAVELL, IPSWICH Telephone: 2124 & 5.

WESTWOOD & WRIGHTS LIMITED
BRIERLEY HILL, STAFFS.
GASHOLDERS · PURIFIERS · WASHERS · CONDENSERS · CASTINGS · STEELWORK · GAS VALVES · WELDED PIPES

MODERN GAS COMPRESSORS

"WALLER" Gas Compressor. Capacity 350,000 cu. ft. per hour, 21 lbs. p.s.i. Single stage, twin cylinder, 12 in. stroke. Direct driven by 560 H.P. L.S.E. Auto-Synchronous motor, 300 R.P.M., 400/3/50 supply. Year 1943.

BELLIS & MORCOM 4 stage Gas Compressor. Capacity 40,000 cu. ft. per hour, 1175 lbs. p.s.i. Direct driven by 300 H.P. L.S.E. Induction motor, squirrel cage winding, 325 R.P.M., 400/3/50 supply. Year 1943.

BELLIS & MORCOM 2 stage Gas Compressor. Capacity 18,000 cu. ft. per hour, 180 lb. p.s.i. Direct driven by 86 H.P. L.S.E. Induction motor, squirrel cage winding, 367 R.P.M., 400/3/50 supply. Year 1943.

GAS HOLDERS

50,000 cu. ft. capacity rivetted M.S. Gasholder. 51 ft. 6 in. dia. × 26 ft. high with 50 ft. dia. × 26 ft. high bell. ¼ in. plate.

15,000 cu. ft. capacity rivetted M.S. Gasholder. 36 ft. 6 in. dia. × 16 ft. 6 in. high, with bell 35 ft. dia. × 16 ft. high. ¼ in. plate.

5,000 cu. ft. capacity rivetted M.S. Gasholder. 20 ft. dia. × 12 ft. 6 in. high with 12 ft. 6 in. high bell. ¼ in. plate.

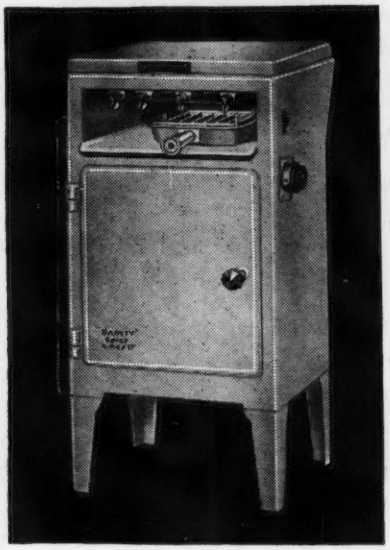
★ *Inspection by arrangement only*

COX & DANKS LTD

Scapa House, Park Royal Rd., London, N.W.10

Telephone: ELGAR 5811

The **Dainty** **CHIEF** . . .



OFFERS YOU A MODERN COOKER with all the advantages of cast-iron construction

R. RUSSELL & SONS Ltd., DERBY

Agents for Scotland and Northern Ireland:
JAMES R. THOMSON & CO., LTD.
10 Blythswood Street, Glasgow, C.2.

GRIDS. .

PURIFIER and SCRUBBER

Telephone:
Brighouse 15 & 651

Thomas Bottomley
(Grids)
LIMITED

RAILWAY SAW MILLS, BRIGHOUSE, YORKSHIRE

GAS RETORTS

HARRIS & PEARSON
STOURBRIDGE, ENGLAND. LTD

INSULATING BRICKS. RECUPERATOR TUBES. SPECIAL SEMI-SILICA QUALITY FOR SEGMENTAL RETORTS WITH NO EXPANSION OR CONTRACTION AT 1400° C

Manufacturers of
Fire Bricks, Lumps & Tiles
OF EVERY DESCRIPTION

PUBLISHERS' NOTICE

The "Gas Journal" is published every Wednesday, price 1/-; by post 1/2d.

Subscription Rates: Home and Empire :- 45/- per annum; Foreign :- 52/- per annum. (Both payable in advance.) A copy of the "Gas Journal" Calendar & Directory is presented each year to continuous subscribers.

Classified Advertisements: All small classified advertisements are charged at 1/6 per line (approx. 7 words) - minimum charge 7/6. A Box Number address occupies 2 lines, and a further 6d. is charged towards cost of postage on replies. Copy must be received by first post on Monday to ensure insertion in that week's Journal.

Displayed Advertisements: Rates obtainable on application to the Business Manager. Change of copy for displayed spaces must be received 14 days prior to publication if proofs are required. Type area of inside pages 10" deep x 7" wide; block screen 120.

BUSINESS MANAGER: S. T. CULLEN

MIDLANDS OFFICE: 10, Union Street, Birmingham.

NORTHERN MANAGER: W. Q. Foster, 33, St. Helens Road, Harrogate. 'Phone: Harrogate 84291.

WALTER KING, LTD., 11, Bolt Court, Fleet Street, London, E.C.4.

Telephone: CENtral 2236-7. Telegrams: Gasking, Fleet, London.

OXIDE

BEST QUALITY DUTCH BOG ORE SPECIALLY ACTIVATED OXIDE OF IRON

which has stood the test of 70 years and rapidly absorbs 60% Sulphur (wet basis). Send your enquiries to

GAS PURIFICATION & CHEMICAL COMPANY LIMITED

ESTABLISHED 1873

PALMERSTON HOUSE, 34, OLD BROAD STREET, LONDON, E.C. 2.

Telegrams: "Purification, Stock, London." Telephone: London Wall 5077

"KLEENOFF"

THE COOKER CLEANER

Tins for Sale to Consumers. In Bulk for Works Use

OXIDE OF IRON.

BALE & CHURCH, LTD.

33, ST. MARY AT HILL, LONDON, E.C.3.

Telephone: Mansion House 1156. Telegrams: "Balefire, London."

The
LIMIT OF EFFICIENCY CAN BE REACHED
by the use of
LUX
GAS PURIFYING MATERIAL

Sole Importers:
HARRISONS (London) LIMITED
66, Mark Lane, LONDON, E.C.3
Telegrams: Birchrock, London Telephone: ROYal 3120

APPOINTMENTS VACANT

DRAUGHTSMAN with sound knowledge of gasworks and allied chemical plant design required. Age 35 or upwards. Pension scheme. Permanent position to suitable applicant.
Fullest details of experience, age and salary, to R. & J. DEMPSTER, LTD., Gas Plant Works, Manchester, 10.

W. C. HOLMES & CO., LTD., have a vacancy for a TECHNICAL ASSISTANT on the staff of their London office, full details of which will be given to suitable applicants.
Applications will be treated confidentially.
Reply to W. C. HOLMES & CO., LTD., 119, Victoria Street, London, S.W.1.

SCOTTISH GAS BOARD

KILMARNOCK GROUP.
KILMARNOCK DISTRICT.
DRAUGHTSMAN.

APPLICATIONS are invited for the position of DRAUGHTSMAN at Riverbank Gasworks, Kilmarnock.
The duties will include the preparation of drawings and specifications for plant required in the production and distribution of gas at Kilmarnock and other district gasworks in the Kilmarnock Group.
The salary to be paid will be within A.P.T. Grade I and II, minimum £390 to maximum £465 per annum, but placing on scale to be according to qualifications and experience.
The successful applicant may be required to pass a medical examination, and to subscribe to such scheme of superannuation as the Board may adopt in the future.
Applications, giving personal details, particulars of training, qualifications and experience, and the names of two referees, to be forwarded to the undersigned not later than July 21, 1950.

ROBERT FIFE,
Group Manager.
Riverbank Gasworks,
Kilmarnock.
June 27, 1950.

EAST MIDLANDS GAS BOARD

NOTTS AND DERBY DIVISION.
CHIEF ADMINISTRATIVE ASSISTANT.

APPLICATIONS are invited for the position of CHIEF ADMINISTRATIVE ASSISTANT to the General Manager of the Notts and Derby Division.
Applicants should be well qualified and experienced to undertake the detailed organisation of the Divisional Office. Experience in the administration of a large gas undertaking will be an advantage.
The commencing salary will be within the range £900-£1,250 according to the qualifications and experience of the applicant.
The successful applicant will be required to undergo a medical examination and the appointment will be subject to such superannuation scheme as may be adopted by the Board.
Applications, giving full particulars of experience and qualifications, together with names of two referees, should be sent to the undersigned to be received not later than July 22, 1950.

A. GWYNNE DAVIES,
Secretary.
Beverley House,
University Road,
Leicester.
June 27, 1950.

SOUTH WESTERN GAS BOARD

SOUTHERN DIVISION.
SUB-DIVISION No. 3.
EXETER AND DISTRICT.
PRODUCTION ENGINEER.

APPLICATIONS are invited for the post of PRODUCTION ENGINEER for the Exeter and District Sub-Division, which includes the following undertakings: Exeter, Exmouth, Sidmouth, Tiverton, Honiton, Seaton, Axminster, Ottery St. Mary, Colyton, Cullompton, Budleigh Salterton, Okehampton and Uffculme.

The person appointed will be responsible to the Sub-Divisional Manager for production within the group, and should have had a sound training and practical experience in large works, including the planning and construction of major production units and ancillary plant.

Candidates must be Corporate Members of the Institution of Gas Engineers, or possess equivalent qualifications.

The salary for the position will be £850 per annum, and the successful candidate will be required to pass a medical examination.

Applications, stating age and full details of education, training and experience, with positions held, together with *copies* of three recent Testimonials, should be delivered to the undersigned not later than 10 a.m. on July 17, 1950.

H. H. BROWN,
Manager.
Exeter and District Sub-Division,
South Western Gas Board,
11-13, Southernhay East,
Exeter.

SOUTH WESTERN GAS BOARD

SOUTHERN DIVISION
SUB-DIVISION No. 5.
PLYMOUTH AND NORTH CORNWALL.
PRODUCTION ENGINEER.

APPLICATIONS are invited for the post of PRODUCTION ENGINEER for the Plymouth and North Cornwall Sub-Division, which includes the following undertakings: Plymouth, Devonport, Launceston, Gunnislake, Callington, Looe, Liskeard, Saltash, Torpoint, Ivybridge, and Tavistock.

The person appointed will be responsible to the Sub-Divisional Manager for Production within the group, and should have had a sound training and practical experience in large works, including the planning and construction of major production units and ancillary plant.

Candidates must be Corporate Members of the Institution of Gas Engineers, or possess equivalent qualifications.

The salary for the position will be £1,000 per annum, and the successful candidate will be required to pass a medical examination.

Applications, stating age and full details of education, training and experience, with positions held, together with *copies* of three recent Testimonials, should be delivered to the undersigned not later than 10 a.m. on Monday, July 17, 1950.

R. J. H. CLARK,
Manager.
Plymouth and North Cornwall Sub-Division,
Fox's Field,
Cattedown,
Plymouth.
June 26, 1950.

APPOINTMENTS VACANT (ctd.)

ASSISTANT REPRESENTATIVE required for London and Home Counties by an established firm of appliance manufacturers.

This position is permanent and progressive. Applicants must be experienced and not over 30 years of age.

Remuneration by salary, commission and expenses.

Replies to No. 9915, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

GAS meter manufacturers require SALES REPRESENTATIVE for Midlands area. Must have up-to-date connections with domestic meter users.

Full details of experience and salary required in confidence.

Replies to No. 9916, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

THE Civil Service Commissioners invite applications for two permanent appointments as EXAMINER (male) in the Ministry of Fuel and Power.

Candidates must be at least 25 and under 35 on June 1, 1950, with extension for regular service in H.M. Forces. They must possess an honours degree in physics with chemistry as a subsidiary subject, or an honours degree in chemistry with physics as a subsidiary subject. Some post graduate research experience would be an advantage.

Salary scale £475-£750. Starting pay is linked to age 25 with addition of £25 for each complete year of age above 25 subject to a maximum of £600.

Further particulars and application forms from the Secretary, Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London, W.1, quoting No. 3175. Completed application forms must be returned by August 3, 1950.

7556/150/MM.

EASTERN GAS BOARD

CAMBRIDGE DIVISION.

WISBECH DISTRICT.

ASSISTANT ENGINEER.

APPLICATIONS are invited from suitably qualified persons for the above appointment.

Applicants should have sound experience of vertical retort house control, with a general works training and possess both drawing office and laboratory experience.

The salary will be A.P.T. Grade IV (£480-£525) with placing according to experience and qualifications. The successful candidate will be subject to such superannuation regulations as may in due course be adopted.

Applications, stating age, qualifications, training and experience, together with names of two referees, should be submitted to the undersigned not later than July 15, 1950.

J. HUNTER RIOCH,
Divisional General Manager.

Divisional Chief Office,
52, Sidney Street,
Cambridge.

WEST MIDLANDS GAS BOARD

WOLVERHAMPTON AND DISTRICT DIVISION.

CRADLEY HEATH DISTRICT.

CHIEF CLERK.

APPLICATIONS are invited from suitably qualified persons for the above appointment.

The successful candidate will be responsible to the District Engineer and Manager for maintaining the financial records of the undertaking and for supervision of the work of the clerical staff and meter collectors.

Applicants should have had extensive practical experience in accountancy as applied to gas undertakings with special reference to cash control and the operation of a detailed costing system.

The commencing salary will be £520 rising to a maximum of £570 per annum. The appointment will be subject to such superannuation regulations as may, in due course, be made, but any existing superannuation rights will be maintained.

Applications, stating age, qualifications and experience, together with details of present and previous appointments with salaries, and giving the names of two referees, should be addressed to Mr. F. C. Briggs, Divisional Manager, West Midlands Gas Board, Kensington House, Bath Street, Dudley, to reach him not later than 14 days after the appearance of this advertisement. Applicants are requested to quote reference T.P.3 when replying to this advertisement.

F. H. CURETON,
Secretary.

WALES GAS BOARD

PONTYPRIDD UNDERTAKING.

DISTRIBUTION AND SALES SUPERINTENDENT.

APPLICATIONS are invited for the position of DISTRIBUTION AND SALES SUPERINTENDENT who will be responsible to the Engineer and Manager of the above undertaking.

Applicants should possess as a minimum the Higher Grade (Supply) Certificate of the Institution of Gas Engineers, or an equivalent qualification, and should have had a wide experience of high and low pressure main laying and of modern distribution and utilisation of gas, including gas fitting. The duties of the successful applicant will also include the development of sales of gas appliances.

Salary will be £550-£610 per annum.

Applications, stating age, training, experience, qualifications, &c., and giving the names of two referees, should be sent to Mr. D. Muir, Engineer and Manager, Gas Offices, Treforest, Pontypridd, not later than July 18, 1950.

Wales Gas Board,
1 and 2, Windsor Place,
Cardiff.

WALES GAS BOARD

LLANWRTYD WELLS UNDERTAKING.

APPLICATIONS are invited from suitably qualified and experienced persons for the position of MANAGER of the Llanwrtyd Wells Undertaking of the Wales Gas Board.

The present sales of the undertaking are 5 mill. cu.ft per annum

Applicants should have had sound experience in the operation and control of horizontal settings and purification plant and must be capable of undertaking the necessary maintenance of mechanical plant. District experience will also be a necessary qualification.

The commencing salary will be £425 per annum, plus free coal and gas within limits. A house will be provided at a reasonable rent.

Applications, giving details of age, qualifications and experience, together with the names of two referees, should be submitted to the undersigned not later than Monday, July 17, 1950.

C. B. MAWER,
Secretary.

Wales Gas Board,
1-2, Windsor Place,
Cardiff.

FINANCIAL

REGISTRATION FOR SALE.

£5,000 authorised capital. Company: "Radiation Research and Components, Limited." All issued shares available on blank transfers. Complete delivery £250.

Write Secretary of the Company, 202, Bishopsgate, London, E.C.2.

PATENTS

KINGS PATENT AGENCY, LTD.

(Director, B. T. King, A.I.M.E., Patent Agent) Advice. Handbook, and Consultations free. 146a, Queen Victoria Street, London, E.C.4. Phone: City 6161.

MISCELLANEOUS

SMALL single truckloads and larger quantities of good ROUGH BREEZE from any gasworks, large or small, in the United Kingdom required by merchants paying own railway tolls. Cash price and particulars to No. 9378, *Gas Journal*, 11 Bolt Court, Fleet Street, London, E.C.4.

CONTRACTS OPEN

WALES GAS BOARD

CAERNARVON GROUP.

TENDERS are invited for the PAINTING OF GASHOLDERS at the following undertakings:

BANGOR.

Gasworks, Bangor, Caerns. Gasholder No. 1, Gasholder No. 2.

CAERNARVON.

Gasworks, Caernarvon. Gasholder No. 1. Gasholder No. 2. Gasholder No. 3.

Further particulars, copies of specification, &c., may be obtained upon application to the undersigned, to whom all tenders in duplicate should be addressed in a plain sealed envelope, endorsed 'Painting.' To be received not later than August 5, 1950.

JOHN R. WOOD,
Group Chairman.

Wales Gas Board,
Gasworks,
Bangor,
Caerns.

REPAIRS

BRIGHT, SON & CO.
(CLERKENWELL) LTD.
FOR PUBLIC LIGHTING.
CLOCK CONTROLLER REPAIRS.
20 Northburgh St. Clerkenwell, E.C.1. Clerkenwell 7171. and at 17 & 18, Gt. Sutton St. Clerkenwell, E.C.1. London Wall 0267.

PAYNE & FLOOD, LTD., 182, Oldham Road, Manchester, 4, Phone Col. 1393, are in a position to undertake all types CARBONIZING PLANT REPAIRS, Retort House Reconstruction, Producer Relinings, Hot and Cold Patching, Structural Steelwork Erected and Dismantled. Expert advice available.

HUMIDINE
NON-SETTING PAINT
Used by the leading Gas Companies for the protection of lower plates and cuppings of Gasholders. The most efficient anti-corrosion paint in existence. HUMIDINE never cracks, never dries and is absolutely impervious to water. OXYGRAFITE GASWORKS PAINT is also manufactured by . . .
ASPINALL'S
(PAINTS) LIMITED
CARLETON - SKIPTON - YORKS
TELEPHONES: SKIPTON 540

n.d.A.

UNDERPRESSURE ENGINEERING CO., LTD.

UNDERPRESSURE CONNECTIONS
SPLIT COLLARS
SOCKET CLIPS

UNION FOUNDRY, MANSFIELD, NOTTS.

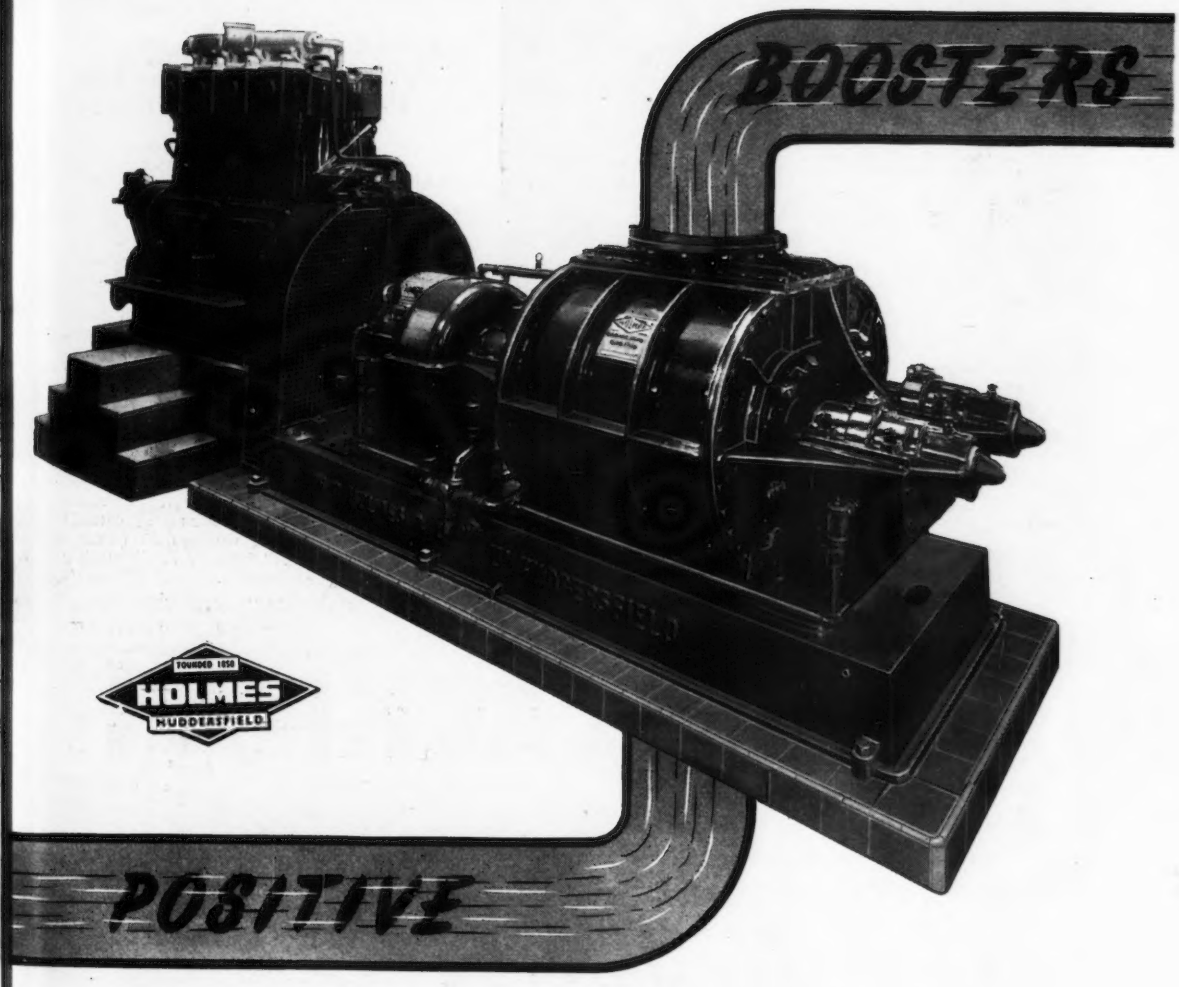
ALL TYPES OF DISTRIBUTION MATERIAL IN STOCK

Service Enquiries:
STAFFORD HOUSE, NORFOLK STREET, STRAND, W.C.2.

'Phone: MANSFIELD 1256. *'Grams:* CASTINGS, MANSFIELD.
'Phone: TEMPLE BAR 9910. *'Grams:* WASHER, ESTRAND, LONDON.

CENTRAL ACTION DRILL STANDS
SERVICE CLEANSERS
TOOLS, ETC.

Holmes — Connersville



Reliable plant means confidence and peace of mind to the engineer.

Efficient operation and years of trouble-free service result from a wise choice of boosting equipment.

Such features are an inherent characteristic of the Holmes-Connersville Booster.

W. C. HOLMES & CO. LTD. · HUDDERSFIELD · LONDON · BIRMINGHAM
Telephones Huddersfield 5280 London, Victoria 9971 Birmingham, Midland 6830

© 313

A "Keith-Blackman" Induced Draught Fan in Operation.

VENTILATION — HEATING

GAS BOOSTING and EXHAUSTING — MECHANICAL DRAUGHT

FURNACE RE-CIRCULATING

FORGE and FURNACE BLAST — COLD AIR DOUCHE

MAN-COOLING — DRYING

WE make all types of Fans—"High Efficiency" for boosting or exhausting gas up to 3 lbs. p.s.i. and for volumes from 5,000 to 1,500,000 cfph; Cast Iron and Steel-plate "Pressure" fans for up to 2 lbs. p.s.i. air blast to furnaces, forges, water gas plants, burner equipment, etc; "Turbo" fans for applications requiring up to 6 lbs. p.s.i.; "Centrifugal" fans for draught on boiler fires to ensure economical steam production, or for cold air douche to workers in retort houses, etc.; "Centrifugal" or "Axial" fans for supplying ventilating air through ductwork; "Propeller" fans for moving air in volume for ventilating; "Propeller" fans on portable structures for cooling workers at furnace fronts; and "Tenaxe" fans for re-circulating high temperature gases and air in various types of heat treatment furnaces.

"KEITH-BLACKMAN"

FANS *for every purpose*

for which fans are essential.

When you need Fans for moving air or gas give us an opportunity of making practical suggestions.

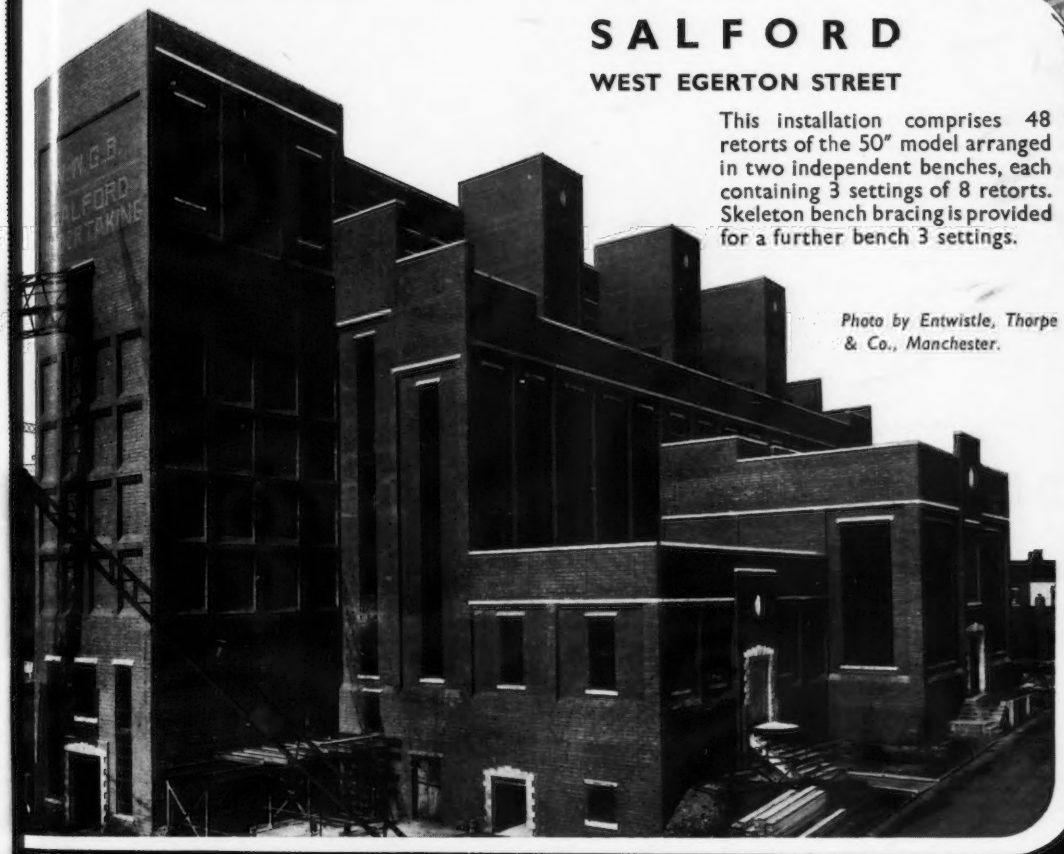
FAN MANUFACTURERS' ASSOCIATION LIMITED

KEITH BLACKMAN LTD
MILL MEAD ROAD, TOTTENHAM, LONDON, N.17.
TN: TOTtenham 4522. TA: "Keithblac Norphone London."

MANCHESTER, 4: 26 Corporation Street. Tel. No.: Blackfriars 4228. BIRMINGHAM, 2: 75 New Street. Tel. No.: Midland 0317-8.
LEEDS, 1: 40/41 Royal Exchange Chambers. TN: Leeds 27286. NEWCASTLE-ON-TYNE 1: 21 Mosley St. TN: Newcastle 22284.
SCOTLAND: 90 Mitchell Street, Glasgow, C1. TN: Central 7973. IRELAND: 7 Brunswick St. Belfast. TN: Belfast 21114.
SOUTH WALES: 127 Stanwell Road, Penarth, nr. Cardiff. TN: Penarth 249.

Printed by STRAKER BROTHERS LTD., E.C.2, for WALTER KING, LIMITED, 11, BOLT COURT, FLEET STREET, LONDON, E.C.4. Wednesday, July 5, 1950.

Work in progress



SALFORD

WEST EGERTON STREET

This installation comprises 48 retorts of the 50" model arranged in two independent benches, each containing 3 settings of 8 retorts. Skeleton bench bracing is provided for a further bench 3 settings.

Photo by Entwistle, Thorpe & Co., Manchester.

...dest's Gas

...MPROVEMENT CO., LTD.

MILES PLATTING, MANCHESTER, 10

Telephone: COLlyhurst 2961-5. Telegrams: Stoker, Manchester.

...on Office: COLUMBIA HOUSE, ALDWYCH, W.C.2. Telephone: HOLborn 4108-9. Telegrams: Wesgasco, Estrand.

STEELWORK

Whether you want

A SINGLE JOIST

OR

A COMPLETE BUILDING

Try

D&R

STEELWORK SERVICE

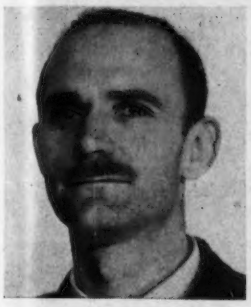
TECHNOLOGY DEPT.

TECHNOLOGY DEPT.

SUPPLEMENT TO

GAS JOURNAL

VOL. 263. No. 4544 102ND YEAR JULY 5, 1950



L. W. ANDREW

GAS WATER HEATING:*

THE CONTRIBUTION OF TESTING TO DESIGN

By L. W. ANDREW, B.A., B.Sc., M.Inst.Gas E.
and C. H. PURKIS, B.A., B.Sc., M.Inst.Gas E.

Watson House, North Thames Gas Board

C. H. PURKIS

THE general question of testing policy was considered by Lacey and Masterman in 1935, but there is little published information on the purpose of appliance testing or on test procedure. It is the main purpose of this paper to interpret the results of tests carried out on water heaters at Watson House since the war.

It is assumed that testing is much more than the carrying out of a fixed schedule of tests in a laboratory and checking results to a pre-arranged standard. If testing is to lead to a real and steady improvement in the performance of appliances, there must be effective co-operation between the laboratory, the district, and the appliance manufacturer. While it is important to standardise methods of test and to apply definite minimum standards of performance whenever possible, the methods and standards must be flexible and progressive, and results interpreted in relation to the function of the appliance. There are also practical features of design such as lighting, ease of cleaning, and noise, which cannot readily be covered by a rigid test method and must be assessed on experience.

The following general aspects of performance are of particular importance:—Safety of operation must be ensured, not only under laboratory conditions, but under all practical conditions of use likely to arise. The hot water service obtained must be related to the purpose for which the appliance is designed and the capital and installation costs. Finally, the overall cost to the user, including capital and running cost, cost of installation, and maintenance must be considered in relation to other appliances and to competitive fuels.

British Standard test specifications applicable to some aspects of performance of gas appliances have operated for many years, for example, standards for combustion and for downdraught diverters; and since the war the need to control the quality of appliances for housing schemes has led to the more comprehensive B.S. 1250, which gives in general terms requirements for construction and minimum performance of domestic gas appliances. Also, since the war a whole series of British Standard Codes of Practice has been prepared on good installation practice. Watson House Standard Methods of Test give methods in more detail and include additional tests.

BRITISH STANDARD TESTS

These tests are by their nature fully agreed by all sections of the gas industry, including the appliance manufacturers, and are subject at the draft stage to comment by all interested parties, including the other fuel industries. Such specifications are an invaluable check on the standard for minimum performance of new appliances and should eliminate those that are dangerous, inefficient, or shoddy.

Acceptance of an appliance on the basis of these standards is, however, a matter of 'pass' or 'fail' to a specification of minimum desirable performance. In spite of revision at regular intervals, this does not encourage appliances of maximum standard of performance. The standards are also incomplete from other points of view, as they do not consider adequately the provision of a hot water service as opposed to tests on an individual appliance; and they do not take into account the future history of the appliance as installed, used and maintained in a home.

WATSON HOUSE TEST PROCEDURE

General

The test procedure attempts to take full advantage of laboratory tests, laboratory development, and district experience. This leads to positive recommendations at the testing stage, a progressive raising of the standards expected, and at times indicates new lines along which appliance development should proceed. The testing position is greatly simplified if mutual agreement has been reached on methods of test and desirable standards of performance, and manufacturers submit with the appliance full details of their own tests.

Co-operation with manufacturers is clearly easier before appliances are in full production, while modification is relatively simple. Ideally, tests are carried out in three stages: on

*From Communication No. 369 of the Institution of Gas Engineers.

a prototype sample, on a production sample, and on check samples from bulk delivery.

Scope of Testing

1. *Standard Methods of Test and Test Schedule*
   Particular emphasis is laid on the combustion performance and the 'practical efficiency' of the appliance. The test schedule is sufficiently detailed to define the construction of the appliance, heat exchange surfaces, operation of valves, &c. A life test is included as a method of assessing maintenance characteristics. The test schedule is the master document on which tests are recorded in full detail and from which subsequent information can be abstracted as required.
2. *General Consideration of Purpose*
   The appliance is considered in relation to existing appliances of similar type and in relation to competitive fuels for a hot water service in existing or new properties. Normally, a new appliance should show a definite advantage over existing appliances in price, appearance, performance, or purpose.
3. *Comments from Other Departments*
   The 'woman's point of view' is obtained with special reference to ease of cleaning, lighting, and general manipulation; such comments are of particular importance for laundry equipment. Detailed comments on engineering standards, general construction and workmanship are obtained from a department specialising in this type of examination. Similarly, comments are obtained on all aspects of installation and maintenance, and on the practicability of storing, handling and full renovation. It remains, however, the responsibility of the hot water laboratory to correlate the comments.
4. *Home and District Tests*
   In normal circumstances it is still desirable to try out new appliances on a small scale before authorising bulk purchase; such test appliances are specially examined, generally after six months and 12 months, and maintenance is only carried out after prior reference to the laboratory.
5. *Checking of Deliveries*
   Special checks are made of initial deliveries against the test reports on the original sample tested, and any unusual features are referred to the hot water laboratory.
6. *Complaints and Defects*
   General contact with the district, and a special defects system enable a watch to be kept on district performance, particularly during the early life of a new appliance.

Standards of Performance

Combustion tests and standards are given in detail in B.S. 717, and the requirement that the $CO:CO_2$ ratio shall not exceed 0·02 at all rates up to 20% overload for governed appliances, and 40% overload for ungoverned appliances is insisted upon.* The overload margin is intended to deal with variations in gas quality, pressure, manufacturing tolerances, and maintenance factors, and reference should be made to the recent paper by Mills and Smith for more detailed consideration. (See later pages.)

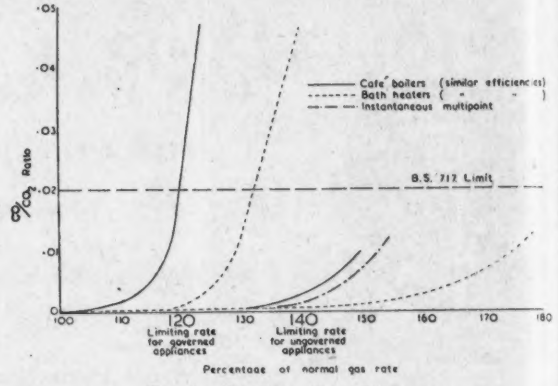


Fig. 1.—Limiting Rate Curves.

The general form of the gas rate, $CO:CO_2$ curve for a water heater is such that at a certain rate the $CO:CO_2$ rises very steeply, and an increase of, say, 5% in heat input above this critical rate will bring the combustion well outside the British Standard limits. The rate at which the $CO:CO_2$ ratio reaches 0·02 is defined as the 'limiting rate.' The maximum permissible rating of the appliance must be such that the limiting rate is not exceeded at the appropriate overload as defined in B.S. 717.

*At the moment B.S.717 uses a 50% and 100% pressure overload; in the revised Standard, it is proposed to adopt a 20% and 40% rate overload.

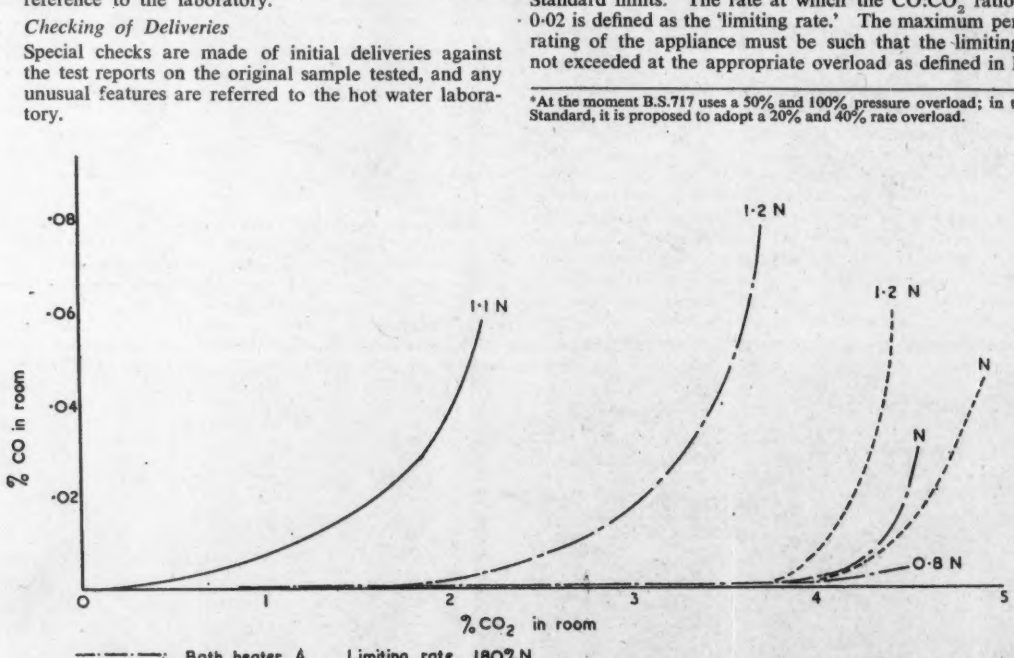


Fig. 2.—Effects of Air Vitiation on Combustion in a Room in which the CO_2 was 4·5% approximately 1 hr. after lighting.

It is important to decide whether or not it is practicable to design appliances to be rated at a heat input well inside that calculated from the limiting rate curve, and at the same time retain satisfactory efficiency and overall dimensions.

Test results show that, at comparable thermal efficiencies, café boilers and single-point bath heaters tend to be rated at the maximum possible input permissible from the limiting rate curve; circulators and central heating units may or may not be rated to the limit; instantaneous multi-point heaters are normally rated well below the maximum permissible rate.

Fig. 1 compares the combustion performance of pairs of café boilers and bath heaters that are regarded as typical of those tested, and also an instantaneous multi-point heater with finned heat exchanger. Any decision on the advisability of accepting the lower margin on combustion will depend on life test results and the likely conditions of installation. This problem must also be considered in relation to the conditions under which the appliance will be used and hazards that might arise under abnormal circumstances, as combustion characteristics are affected if there is vitiation of the air in a room due to inadequate clearance of products of combustion.

Fig. 2 compares the combustion of appliances under conditions of air vitiation, and the greater margin on the appliances below their limiting rate is even more marked. It is shown that it is possible for an appliance of satisfactory efficiency to maintain good combustion at an air vitiation of 3½% of CO_2, and this is a target at which to aim.

With bath heaters it is most desirable to operate well inside the limiting rate as they are often fitted in small rooms and downdraught might take place. Specific recommendations are given by Mills and Smith and can be summarised as follows:—The combustion margin should be as wide as possible, the rating of the heater should be dependent upon the size of bathroom, and there must be adequate inlets for fresh air. It is desirable that a limiting rate should be included as a standard test on all water heaters, and is regarded as essential for bath heaters; wherever fitting conditions are difficult, a heater should be chosen on which a wide margin on rate is available.

The tests on air vitiation indicate that conditions might still be unsatisfactory in small rooms if termination is of necessity in a difficult position; for example, under a balcony. It is desirable to develop a balanced flue appliance for such situations, as this allows the appliance to be isolated from the room. Combustion standards for balanced flue appliances are not yet decided, but it seems reasonable to adopt B.S. 717 for operation in still air, with the proviso that under no wind condition shall the pilot flame or the main burner be extinguished.

Life Tests

An intermittent type of life test has been adopted as standard in order to obtain accelerated corrosion of the heater as well as wear of moving parts. The actual time cycle will depend on the heat capacity of the appliance, as it is desired that it should cool down fully after each heating; as an example, the instantaneous heater with finned heat exchanger operates on a cycle of 10 min. on and 5 min. off, but with a cooling water by-pass on.

A final decision has not yet been reached on the fairest method of assessing the results of a life test and of identifying the end-point. The safety of operation of the appliance is of major importance, and this is normally assessed by examination of the rise in the percentage of carbon dioxide at the primary flue outlet. Three methods of assessing the end-point have been tried: firstly, on the basis of the appearance of the flames; secondly, on a limit of carbon dioxide of 10% or preferably the reaching of a carbon dioxide content equivalent to 80% of the theoretical maximum; and thirdly, the carrying out of the British Standard tests on the combustion of the heater as the tests proceed. The simplest method at the moment is to work to a definite excess air content, and this is satisfactory in many cases, but there still remain sampling problems with certain appliances.

It is important to distinguish between the results of a life test on a heater as in normal use, and one in which the characteristics of a heat exchanger are being examined. In the first case, it is necessary to maintain a constant inlet pressure while recording any changes in gas rate that take place from the point of view of change in hot water service. In the second case, the heat input should be maintained constant. The whole question of the use of constant-pressure or constant-volume governors is bound up with both corrosion of the heat exchanger and corrosion of burners. These two problems have still not been solved, but Fig. 3 draws attention to some life test figures, using constant-pressure and constant-volume governors and different types of burner.

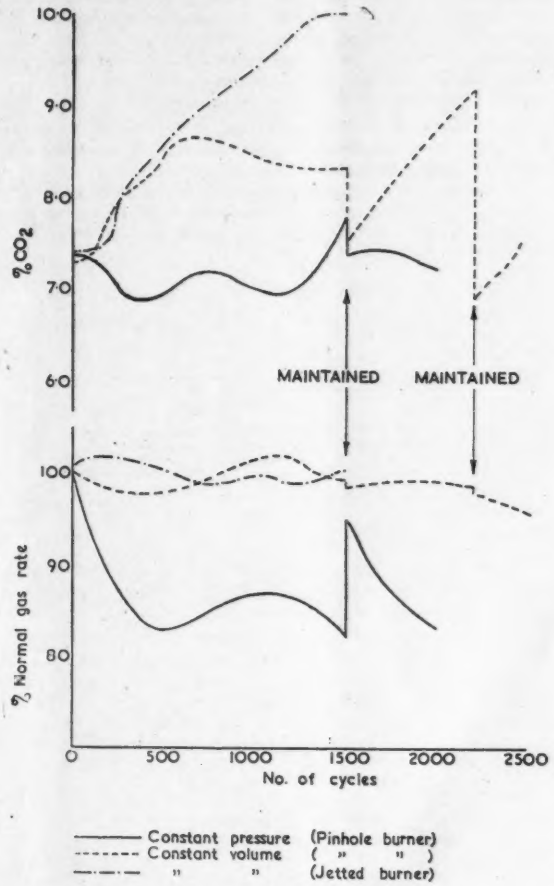


Fig. 3.—Life Test Results.

In order to assess the nuisance value of any corrosion products that might fall out of the appliance and annoy a consumer, such products are collected in a tray immediately underneath the heater. It is important, whenever possible, to carry out a second life test after the initial one has been completed and a normal maintenance carried out. This second test frequently shows up those protective finishes that might be admirable for an initial period, but have a limited protective life.

It is generally considered that a reasonable performance is given by an appliance that gives satisfactory combustion, retains its heat output within 10% and has little nuisance value after a test of 1,500 cycles.

Laboratory measurements of thermal efficiency and flue loss under specified conditions of test are of prime value in assessing the relative performance of appliances of the same type. A thermal efficiency of 80% is a reasonable upper limit if trouble due to corrosion of the appliance and condensation in the flue system is to be avoided.

It is, however, realised more and more, that for domestic appliances the efficiency of water heaters must ultimately be assessed in terms of the gas needed to provide a hot water service. It is for this reason that an arbitrary detailed schedule of weekly use of hot water has been drawn up in which the amount and temperature of water for baths, washing up, ablutions, &c., have been defined. This schedule assumes a use equivalent to 150 gal. of water a week at 140°F. If the efficiency is 75%, it should be possible to obtain this adequate service for a family of four for 1¼ therms per week all the year round, or 1½ therms a week in the summer.

General experience shows that instantaneous heaters might use 2½ therms for all the year round service, whereas storage heaters may exceed 4 therms per week for equivalent use. The problem with the instantaneous heater is that of the pilot flame consumption and the heat capacity of the appliance when very small quantities of hot water are drawn off; with the storage heater it is the stand-by loss of the storage system.

These factors have led to the use of dual return to reduce heat losses from the storage vessel when bath use is not anticipated, to improvements in standards of insulation and to an examination of the savings obtained by intermittent use of the system. Table 1 summarises results obtained, using different systems, different standards of insulation and continuous or intermittent working.

TABLE 1.—*Storage Water Heating. Running Costs.*

30 cu. ft. Circulator and 30 gal. Steel Cylinder insulated with 1 in. Asbestos. 150 gal. schedule for Summer use.

System and Method of Use	Therms per Week
Full Storage; uninsulated flow and return pipes; continuous use ...	4·6
Divided Storage; uninsulated flow and return pipes; continuous use	4·0
Divided Storage; insulated flow and return pipes; continuous use...	3·0
Circulator used intermittently for baths only, plus sink heater for small draw-offs	2·4
(Instantaneous sink heater plus bath heater)	(2·1)
Theoretical, assuming 75% appliance efficiency	1·5

The widespread use of solid fuel for a winter hot water supply makes it particularly desirable to consider gas appliances of low capital and installation costs for summer hot water. It seems reasonable to pay special attention to methods that take full advantage of the flue system and circulating system of an existing hot water installation. There is need at the moment for simple conversion units which the consumer can change over, and Fig. 4 shows conversion units for existing

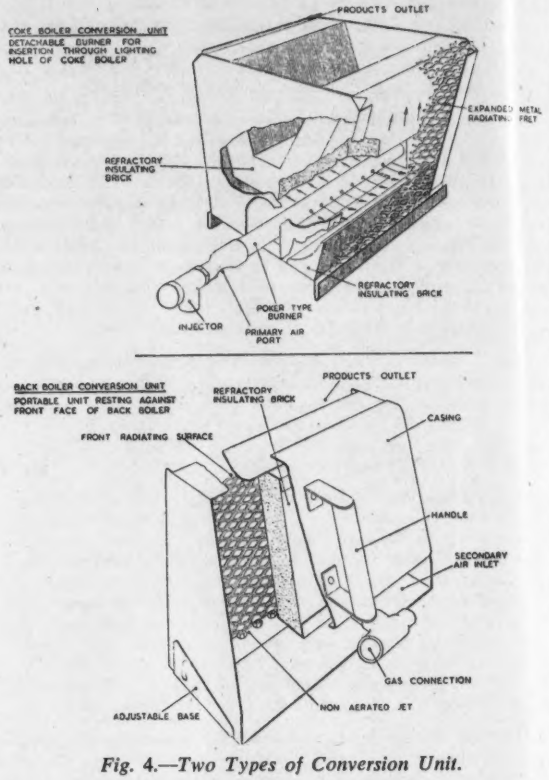


Fig. 4.—Two Types of Conversion Unit.

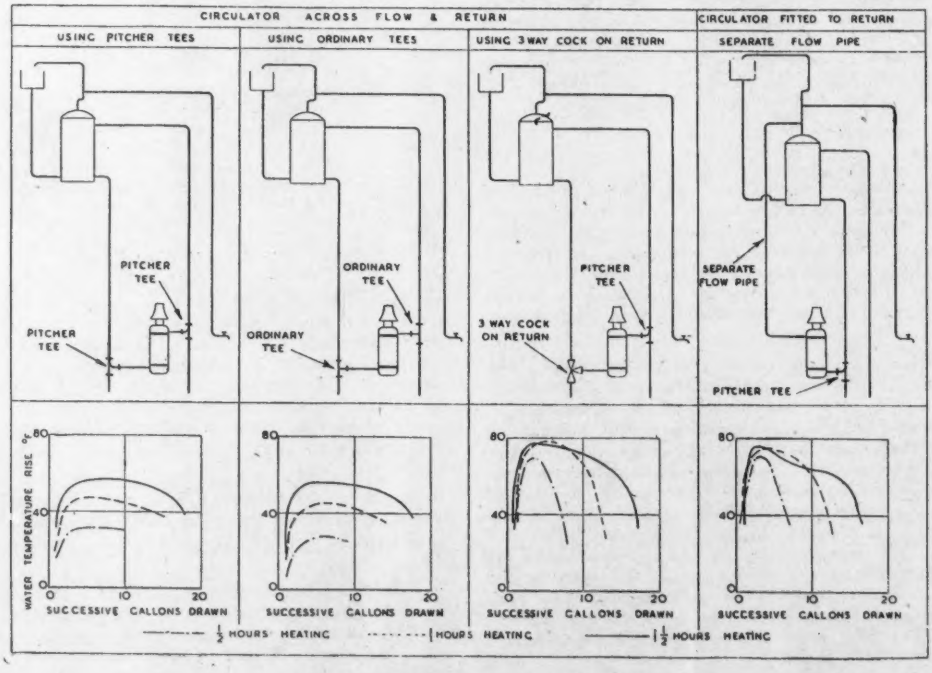


Fig. 5.—Installation of Circulators—I.

back boilers and coke boilers. These units can be placed in position by the user, and owing to their high radiant output need not fit precisely the water-cooled surfaces. Even if insulation of the system is poor, such units can be used intermittently at a reasonable running cost to provide bulk water heating only.

There is also need for dual-purpose appliances and for simpler methods of connecting a circulator into flow and return pipes while avoiding inter-circulation with the solid-fuel appliance. Here again, however, the problem is simplified if only intermittent use is considered. If a circulator is to provide a full hot water service at a reasonable cost, the best method of installation known at the moment is to connect the circulator to the storage vessel by independent flow and return pipes. Such an arrangement may, however, prove impracticable, and it becomes necessary to use the existing flow and return connections of the solid-fuel boiler. Inter-circulation with the solid-fuel boiler has two adverse effects; it reduces substantially the maximum temperature rise of the flow to the storage vessel, and also in continuous operation affects the running cost, as some heat loss from the solid-fuel boiler is added to that from the rest of the system. Fig. 5 shows the temperature rise obtained after a definite time interval with various methods of installation, and shows the effect of inter-circulation with the solid-fuel boiler in the absence of an isolating valve.

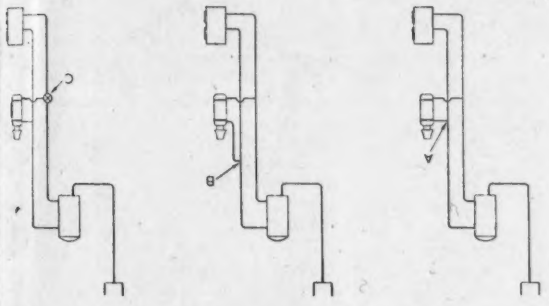


Fig. 6.—Installation of Circulators—II.

The consequences of inter-circulation were further studied by carrying out normal running cost tests on the systems shown in Fig. 6, using a 30 cu. ft./hr. circulator with thermostat in the return. Arrangement 'A' gave the 150 gal. schedule (summer use) for 5·0 therms per week, but owing to inter-circulation it is not possible to draw off water above 118°F.; the riser 'B' gave 5·1 therms per week, the average temperature of 'useful' hot water drawn being 134°F.; and the isolating cock 'C' gave 4·7 therms per week, the water temperature being 144°F. It will be seen that arrangement 'C' gives the best service for the lowest running cost, but in the absence of an isolating cock the riser 'B' leads to a real improvement in the service given.

Overriding all these considerations, it must be remembered that a limited intermittent service is only justified if there are marked savings in capital, installation and running costs over the more desirable continuous service.

Setting of Appliances

There will always be changes in Wobbe Number and pressure of gas delivered to a water heater. The present combustion tests are intended to ensure that the safety of the appliance is maintained, but there remains the problem of providing a satisfactory hot water service under these varying conditions. The problem is most acute for the instantaneous water heater that is not thermostatically controlled and deals with an inlet water temperature between 40° and 70°F.; this allows only a small margin between really hot water in the winter and over-heating in the summer.

Table 2 shows the effect on temperature rise, for a fixed setting of the water throttle, of a change in Wobbe Number of ±10% if the appliance is set to a fixed gas rate at any particular Wobbe Number; also the effect of ±25% change in inlet pressure.

TABLE 2.—*Effect of Changes in Wobbe Number and Gas Pressure on Performance.*

Water throttle set initially to give 70°F. temperature rise.

Effect of Change in Wobbe Number when Appliance Operates at a Constant Gas Pressure	Wobbe Number as Initially Set	Wobbe Number when Used					
		110% of Normal		Normal		90% of Normal	
		Heat Input %	Temp. Rise (°F.)	Heat Input %	Temp. Rise (°F.)	Heat Input %	Temp. Rise (°F.)
	110% of Normal ...	100	70	91	64	82	57
	Normal ...	110	77	100	70	90	63
	90% of Normal ...	122	85	111	78	100	70
Effect of Change in Gas Pressure when Appliance Operates on Gas of a Constant Wobbe Number	**Pressure as Initially Set**	**Pressure when Used**					
		125% of Normal		Normal		75% of Normal	
		Heat Input %	Temp. Rise (°F.)	Heat Input %	Temp. Rise (°F.)	Heat Input %	Temp. Rise (°F.)
	125% of Normal ...	100	70	89	63	77	54
	Normal ...	112	78	100	70	87	61
	75% of Normal ...	129	90	116	81	100	70

It is considered essential that all water heating appliances should be supplied with a governor and fixed gas rate control so that automatically the heat input is set to a mean Wobbe Number, and also pressure fluctuations are minimised. The only legitimate exception at the moment is a simple bulk heater used intermittently; for example, the cheap wash boiler when on grounds of cost the governor might be replaced by a simple choke and pressure test point.

Practical Service Given

The minimum temperature requirements for providing a domestic hot water service are generally agreed at 110°F. for bathing and 140°F. at the sink, while the inlet temperature varies from 40°F. to 70°F. The permissible upper limit is less well established, but general experience suggests that 160°F. should not normally be exceeded in hard-water districts if serious scale deposition is to be avoided.

The desirable speed of delivery of water for baths, and the permissible time interval between successive baths, cannot be accurately defined, as a lower standard of service may be acceptable if compensated by a definite and marked saving in capital or running cost. Experience, however, suggests that an instantaneous bath heater delivering less than 1½ gal. a minute at 110°F. would be unsatisfactory, especially if the user has a solid-fuel boiler for winter use. The speed of delivery from a storage system should always be satisfactory and may well be 5 gal. a minute, but there remains the problem of adequate recovery rate to provide successive baths.

The rating of circulators and storage heaters is clearly linked with the storage capacity, and there has been a trend in recent years to adopt too low a rating to give the first-class service that gas storage heating should give.

Table 3, calculated on an efficiency of 75%, compares the size of vessel and gas rate needed to give two or three baths at half-hour intervals, and also shows the approximate rating of an electric heater to give a similar service.

The main merit of a low gas rate is that the appliance might be used fluelessly, and this is possible for appliances rated below 10 cu. ft./hr. if fitted under favourable conditions. It seems reasonable, however, to consider gas rates of 40 to 60 cu. ft./hr. if a flue installation is needed.

It is also important to consider the advantages of a high gas

TABLE 3.—*Relation between Storage Capacity and Heat Input.*

Heat Input		Theoretical Volume of Storage Vessel to give:	
Cu. ft./hr. at 75% efficiency	kW. at 100% efficiency	Two 15 gal. baths at 140°F. at ½-hr. intervals (gal.)	Three 15 gal. baths at 140°F. at ½-hr. intervals (gal.)
12	—	27	40
—	2	26	37
—	3	24	33
30	—	23	32
40	—	21	27
60	—	17	19

rate for appliances intended for very intermittent use; for example, bulk heaters used only a few times each week. Table 4 compares the time and gas used and storage capacity to give one bath and two baths when the appliance is used intermittently for bulk heating: two appliances are taken, a simple conversion unit at 55% efficiency and a circulator at 75% efficiency.

TABLE 4.—*Bulk Heating.*

(A = Time, in minutes. B = Gas Consumed, in cu. ft.)

Storage Capacity (gal.)	Calculated Time and Gas Consumption to give one and two 15 gal. Baths at 140°F. from 65°F.											
	Number of Baths	Conversion Unit. No Stratification. 55% Efficiency. 40 cu. ft./hr.		Circulator Stratification 75% Efficiency							
				12 cu. ft./hr.		30 cu. ft./hr.		40 cu. ft./hr.		60 cu. ft./hr.	
		A	B	A	B	A	B	A	B	A	B
20	1	80	53								
	2	120	80								
25	1	100	67	150	30	60	30	45	30	30	30
	2	120	80	300	60	120	60	90	60	60	60
30	1	120	80								
	2	120	80								

The problem on the instantaneous multi-point heater is to provide a temperature rise of 100°F. in winter while avoiding overheating in the summer. It is normal to take advantage of the difference in minimum flow on an opening and closing valve, and to fit the heater at the sink so that some tap 'twiddling' is possible at the sink during the coldest weather. The tendency has been to limit the temperature rise to 100°F. on a closing valve, which has meant 80°F. on an opening valve. The latest trend is to operate at 95° to 100°F. on an opening valve and to reduce as far as possible the flow differential between opening and closing. This change is being watched with interest, but appears to be in the right direction.

Practical Test Experiences

Some of the test results obtained over the past five years will now be surveyed against the background of the previous sections of this paper. A wide variety of water heating appliances has been tested coming from nearly 70 different manufacturers, and improvements (some small, some large) have resulted in most if not all cases. A very brief summary of the results of laboratory tests is given in Table 5. These results refer to samples as first received from the makers, and in all cases positive recommendations were made. In nearly every case the final sample received was modified to satisfy at least the minimum requirements of B.S. 1250.

WASH BOILERS AND WASHING MACHINES

The standards of performance that have been laid down in B.S. 1250 for these appliances are lower than for any other type of water heater, but even these minimum standards are not always attained in practice. Thus, out of 61 appliances examined, 15 were received without any form of gas control, seven failed on combustion, 12 gave too low a thermal efficiency, and 21 gave rise to excessive surface temperatures.

Testing has made three main contributions to the design of wash boilers and washing machines. The first has been to draw attention to the design and positioning of the burner. By reducing the conventional burner diameter, by correct location of the burner below the pan, and by correct sizing of the air port it is possible with no increase in cost to increase thermal efficiency by 20% (*i.e.*, from about 50 to 60%), to reduce surface temperatures, and with fixed air ports to provide a flame that is stable on gas of A.T.B. No. 50 and gives satisfactory combustion on gas of A.T.B. No. 85. More substantial increases in efficiency with corresponding reduction in boiling time have been achieved by simple finning of the base of the pan. In an extreme case of a rather small circular boiler, which had already been constructed in large numbers, the provision of 16 radial fins was shown to increase efficiency from 46 to 66%, surface temperatures being reduced from 350° to 240°F.

The second concerns the actual washing performance which

TABLE 5.—*Summary of Laboratory Tests on Appliances as Originally Received.*

	Wash Boilers	Washing Machines	Inst. Sink Heaters	Inst. Bath Heaters	Inst. Multi-point Heaters	Storage Heaters	Circulators	Central Heating Units	Café Appliances	Conversion Sets
1	2	3	4	5	6	7	8	9	10	11
Tested	47	14	13	11	10	14	13	14	20	4
Combustion Unsatisfactory at Makers' Rating (B.S. 717)	7	0	0	9	2	3	3	5	11	1
Draught Diverter Failed Badly	—	—	—	5	1	1	3	2	—	No. D.D. on 2
Efficiency Too Low (B.S. 1250)	11	1	2	2	1	1	5	6	7	—
Surface Temperatures Too High (B.S. 1250)	19	2	0	0	0	0	3	7	8	—
Unsuitable Materials	17	4	10	1	3	0	4	0	0	1
Threads Non-standard (B.S.)	4	3	7	6	6	4	10	3	8	0
No Pressure Point	—	—	3	3	3	2	4	3	3	1
Full Maintenance Impossible Using Standard Tools	5	2	12	2	2	0	2	0	Nearly all	0

has not until very recently been covered by any test method; indeed, many aspects of the washing process cannot easily be covered by any hard and fast test. The new standard method of test, however, not only compares washing performances, but attempts to assess other factors of practical importance during the washing process. As a result, special attention has been given to the possible spillage of water between the pan and the cornice, and to guiding water that is removed from the clothes during wringing back into the pan or forward into a suitable receptacle without dripping on to the floor. Attention has also been given to facilities for securing the wringer by means of a screw that the housewife can operate readily with wet and soapy hands.

Other points include the steadiness of the appliance when wringing, the possibility of 'burning' fingers on small recessed handles, the height of the drain cock above floor level (which should be at least 11¼ in. to accommodate a household bucket), and the effective trapping of condensate both to avoid mess and the impression that the pan is leaking.

A third improvement is the avoidance of any feature that might result in the marking of clothes. For this reason, emphasis is laid on the provision of a pure tin coating on copper pans, since vigorous rubbing of white articles on the side of a pan coated with a tin/lead solder invariably gives rise to grey or black marks on the clothing. In order to avoid any possibility of rust, even small parts such as the cage of a ball race, or the screw that secures the lid handle, must be made from non-ferrous materials or stainless steel; the practice of using vitreous enamelled steel lids and cornices has also been discouraged, since one chip may give rise to trouble.

Instantaneous Sink Heaters

The complex design of this type of appliance is generally a sufficient guarantee that a manufacturer willing to undertake its production can also be relied upon to ensure combustion and efficiency to B.S. 1250. The main contribution of testing lies in balancing the demand for an improved hot water service against possible subsequent trouble due to corrosion, scale formation and ceiling staining. It is regarded as most important that the heat input to the appliance shall be accurately controlled independently of the consumer. In a recent life test on three similar appliances operating respectively at 60, 70 and 80 cu. ft./hr., the heat exchanger of the 80 cu. ft./hr. heater was completely blocked after 1,200 cycles, whereas the others operated successfully after 1,800 cycles. Such considerations underline the demand for a gas governor as an integral part of the appliance. In view of the importance of taking a burner pressure in order to check the rate of a governed appliance or adjust the rate of an ungoverned appliance, it is surprising to note that several sink heaters have been submitted for test without a pressure point. Some others have pressure points that are quite inaccessible or are in positions so hot that rubber tubing would be unusable.

Instantaneous Bath Heaters

This type of appliance above all others should have a particularly high standard of combustion. It is therefore disquieting to report that so many appliances of this type were, as initially tested, so bad from the point of combustion.* Nine out of 11 heaters failed to satisfy B.S. combustion standards at the maker's rating, and five out of 11 draught diverters failed badly under downdraught conditions. This position was aggravated by the lack of provision of any gas control or even the provision of an integral draught diverter in some cases.

The cause of inferior combustion is generally to be sought in restriction of the flue ways within the appliance in an attempt to provide the necessary efficiency when heat transfer area is inadequate; it is quite common to find in a drum-type heater that the annular flue way between the drum and the outer jacket is considerably smaller in area than that of the flue spigot. At times it was possible to increase the permissible rating and still maintain thermal efficiency by a simple modification to the drum to give a larger flue way; at other times it was necessary also to increase the available surface area for heat transfer by simple finning.

The failure of draught diverters is sometimes due, not to any weakness in the diverter itself, but to recirculation of products. The shape of the top of the appliance may be such that under downdraught conditions the products cling to the side of the case and re-enter the appliance at the combustion chamber. A simple modification to the top member (for example, provision of a concave instead of a convex surface) may make all the difference between successful and unsuccessful performance.

Instantaneous Multi-point Heaters

The problems are similar to those of the sink heater, but complicated by the need to control at a water tap distant from the appliance.

Laboratory life tests have helped to assess the necessary frequency of maintenance and probable life of the heaters, in addition to revealing such weaknesses as delayed ignition, fatigue of bimetal strips, perforation or distortion of governor and valve diaphragms, imperfect jointing in water coils, noisy operation, 'banging' on shut-down, and so forth. Testing has stressed the importance of careful application of protective coatings, it has resulted in the enlargement of at least one heat exchanger, and has influenced not only the materials used in pin-hole burner construction, but the development of entirely new types of burner.

Storage Heaters and Circulators

Work on running costs of storage systems has been described in detail elsewhere. In one maker's appliance subsequently tested, divided storage with an economy valve was included, but reliance was placed on the insulation provided by the air space between the storage vessel and the outer cabinet. Insulation of the cylinder and flow and return pipes with ½ in. hair felt reduced the weekly running cost from 3·5 to 2·8 therms per week.

Central Heating Units

Central heating units normally operate at 75 to 80% efficiency, providing adequate heat transfer area is available and the design is such that the distribution of products of combustion is uniform over the heating surfaces and correct use is made of the incoming excess air. Uneven air distribution can generally be detected by observation of the flames, or by carrying out a CO_2 traverse across the flue ways between sections. Such distribution is undesirable, since it may lead to local condensation or overheating, or under adverse conditions to local smothering and sooting. The cure generally lies in a suitable modification to the size and position of air inlets, or in the development of a suitable restrictor above the flue ways. Flame instability may result from turbulence in the gas stream due to rough burner casting, or sudden changes in direction, or the use of small-diameter burner floats and correspondingly high linear gas velocities. In this connection it is advantageous from the point of view of flame stability to use luminous jets with gauze inserts, but this advantage may be offset by deposition on the gauzes due to 'cracking' of hydrocarbons if the burner temperature is unusually high.

Efficiency measurements require careful interpretation, since too high an efficiency may lead to heavy condensation and attendant corrosion troubles; it is considered that the thermal efficiency should not be less than 75% and should not exceed 80%.

Laboratory tests and district experience show that too little attention has been given in the past to maintenance of these units. They are generally in continuous operation for seven months of the year, and although the return water is usually above condensation temperature (except in the case of central hot water units) corrosion is considerable. Sectional units are of cast iron or welded steel, and until very recently have received no surface protection. The corrosion deposit accumulates in the narrow flue ways and will restrict excess air and ultimately affect combustion. Simple access for maintenance, preferably from two directions and without breaking the flue, is therefore vital. Insistence on this feature has resulted in offset flues on many units to permit top access, or alternatively the building of

*It should be appreciated that a deliberate attempt was made to check bath heaters from suppliers having limited technical facilities.

the top casting in two halves with a central flue, the weight of the flue being taken on the sections. Other units, again, have easily removable side or back panels to enable cleaning brushes to be passed right through the unit.

One series of central heating units was originally designed with loose baffle plates fitting between the sections. These were found to warp in practice and interfere with the passage of cleaning brushes; in collaboration with the makers these baffle plates were removed and replaced by a restrictor plate fitted above the sections, and in the case of the larger units in the series this plate was designed to even up the air distribution.

The safe lighting and subsequent operation of these units is of great importance, and has been fully considered in laboratory and district investigations. It has been found in testing that many appliances were provided with pilot burners made of corrodible material; in six cases the flame-failure pilot would not light the main burner; and in three cases the flame-failure device came after other controls in the weep line of a relay valve, and would therefore be inoperative in the event of a leak at any previous control or joint. The whole problem of safe lighting and subsequent protection against flame failure has resulted in the drawing up of a detailed statement of requirements, in collaboration with all manufacturers of gas central heating units.

Café Appliances

Unlike most water heaters, these appliances operate in full view of the general public, and are indeed intended in many cases to attract custom. Moreover, they are used fluelessly. It is disappointing that these appliances are probably of a lower standard than other gas equipment from the point of view of combustion, and in certain other respects.

Traditionally, café boilers are rated on output, which in competitive business has tended to become exaggerated. Of two well known makes recently tested, one gave a limiting rate that just equalled the input required to give the rated output, while in the other case the required input actually exceeded the limiting rate.

A café boiler does not, however, present combustion problems different from any other type of water heater, and some makes operate successfully with a wide margin of safety. As with unsatisfactory bath heaters, poor combustion is normally due to an attempt to increase efficiency by restriction of the flow of products, and in the worst case referred to above the products of combustion of 140 cu. ft./hr. of gas were required to pass through a flue of 2 in. dia.

Café appliances normally operate at 60 to 65% efficiency for delivering boiling water, and this low value is partly due to the demand for a high output from a given size of appliance, and partly to the need to ensure that water at boiling point is immediately available as required. Nevertheless, there may be a lack of sufficient surface area for heat transfer, and in many designs it may be doubted whether effective use is made of all the area nominally available. In one particular case a café boiler failed on combustion and gave a thermal efficiency of 55%; a simple redesign of the heat exchanger without affecting overall dimensions was suggested, as a result of which combustion requirements were satisfied with a substantial margin at the maker's rating, and the thermal efficiency was increased to 64%, so that the maker's rated output was easily attained.

Conversion Units

Technical problems in the design of conversion units for domestic solid-fuel boilers arise on account of the diversity of boilers on the market, the desirability of simple interchange between gas and solid-fuel firing by the consumer and the unknown characteristics of the installation, which may result in excessive running cost if used unwisely. Testing must take all these problems into account.

Combustion performance is influenced by the type of burner used, the proximity of jets to water-cooled surfaces, and the free area of the flue way. Unless special precautions are taken or instruction given, the flue area may be varied within wide limits by consumer adjustment of the damper. Table 6 shows the improvement in combustion performance and relatively small drop in efficiency that resulted in one particular case from opening the damper and from increasing the spacing of the jets from the water jacket.

Table 6.—*Combustion and Efficiency of a Conversion Unit.*

Solid-fuel Boiler Type	Position of Boiler Flue Damper	Distance of Jets from Water-cooled Surface (in.)	Nominal Heat Input (B.Th.U./hr.)	Thermal Efficiency (%)	CO:CO_2 Ratio	
					Normal	40% Rate Overload
A	Shut	¾	15,000	58	0·036	—
	Shut	1¼	15,000	55	0·013	—
B	Open	1¼	20,000	47	0·005	0·016
B	Shut	1¼	20,000	53	0·008	0·030

Special attention should be paid to ease and certainty of quiet ignition, and it is regarded as preferable to light the burner outside the boiler.

The most important contribution of testing, however, concerns the application of a conversion unit in practice. Provided that its use is limited to bulk water heating, the relatively low thermal efficiency of the conversion unit and high heat losses from the system are of minor consequence. If, however, any attempt is made to use such an arrangement for a full hot water service, embodying thermostatic control, running costs could become prohibitive.

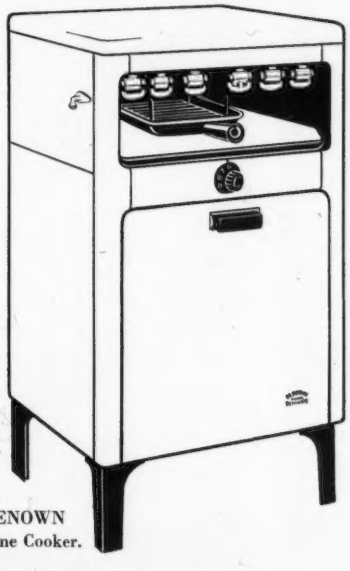
Scottish Rural Gas, Ltd., of Perthshire Chemical Works, Friarton, Perth, have been given authority to build a factory and offices at Sighthill Industrial Estate at a cost of some £12,500. This decision expands the scope and activity of this organisation in the Edinburgh area and takes it nearer the heart of the Scottish oil and gas industry than to date. Scottish Rural Gas, Ltd., was one of the first firms to develop a national distribution system for bottled gas in Scotland with depôts in all the main centres.

Investigations into the possibility of exploiting coal reserves in Lanarkshire more fully by the use of low-temperature distillation were advocated by Mr. J. McKendrick, a National Union of Mineworkers' representative, at a recent meeting of the Scottish Reconstruction Committee. He said that while investigations were being held up the policy of closures of collieries in the Clyde Valley was still continuing and, consequently, hundreds of miners were becoming redundant. The N.C.B. has indicated to the Committee that the coal it could release for a distillation project would be of poor quality. It might be necessary to augment local supplies with coal from other areas possessing the caking qualities required for the process.

An indication of the value of 'productivity reports' from teams visiting America to study the techniques in various industries has been given by Mr. F. Rowe, Chairman of the British Steel Founders' Association. In his opinion there has been a most striking change in the attitude of employers and workers to productivity. At a technical convention held recently to report progress since the team's recommendations were published, representatives of the steelfoundry industry referred to savings in time, material, and power consumption and in man-hours per ton produced which showed substantial improvements in productivity and promised more for the future.

Industrial disputes in 1949 analysed in the 'Ministry of Labour Gazette' show that stoppages of work in the coal-mining industry and at the docks were responsible for over two-thirds of the aggregate time lost. More than 42% of the stoppages which began during the year were caused by wage disputes, but less than 6% were directly related to demands for wage increases. Some 313,100 workers were directly concerned in stoppages which began during the year. The total of all those involved, including workers rendered idle although not parties to the disputes, in stoppages which started or were already in progress in 1949 was about 350,000. Of these, about 200,000 were in the coal industry and 35,000 in water transport and docks. Some 754,000 working days were lost through disputes in the coal industry last year.

". . very interesting—but give ME my



The RENOWN
Clean-line Cooker.

PARKINSON

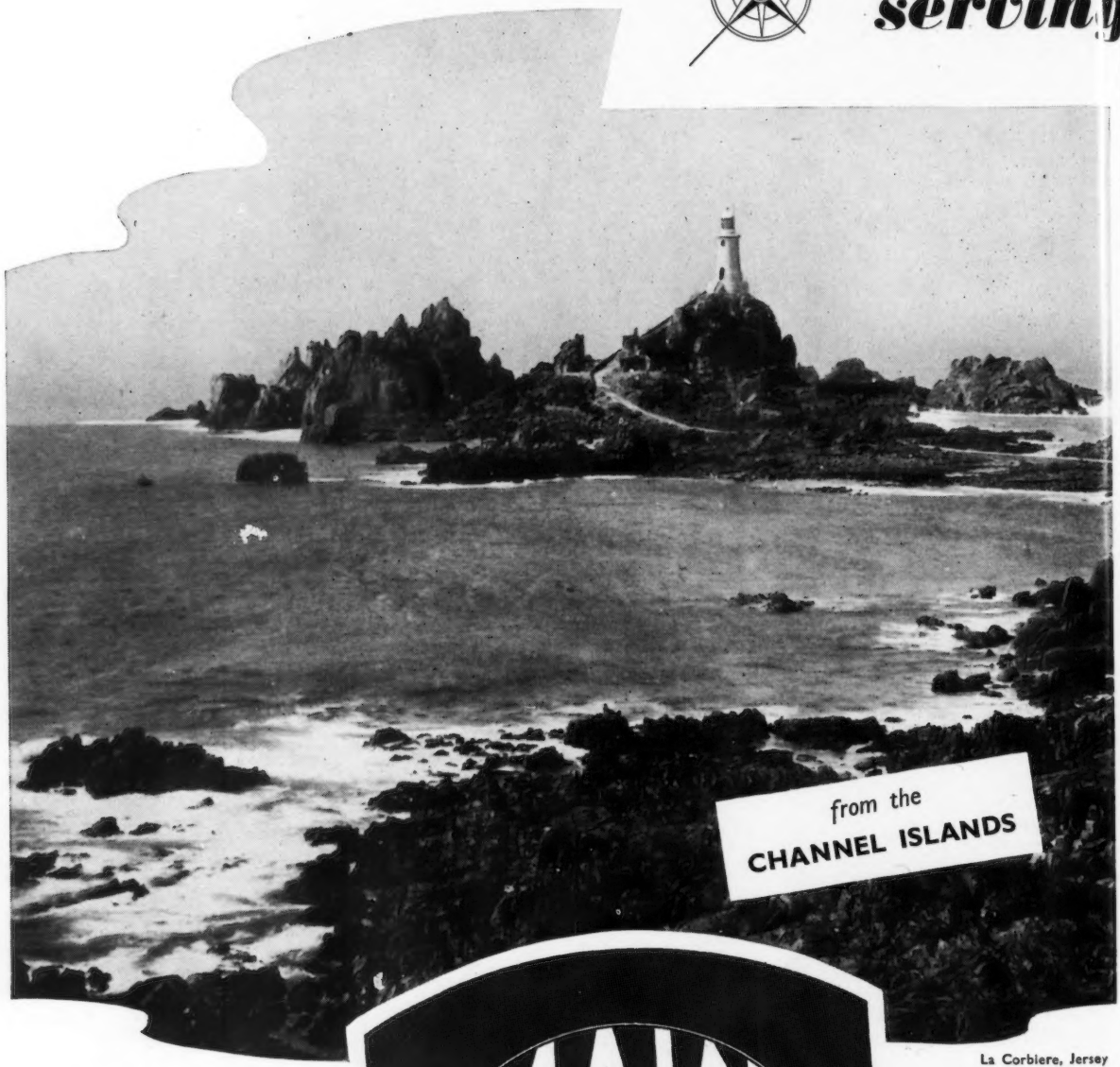
FOLDING COVER TOP

for preference"

THE PARKINSON STOVE CO. LTD. BIRMINGHAM 9

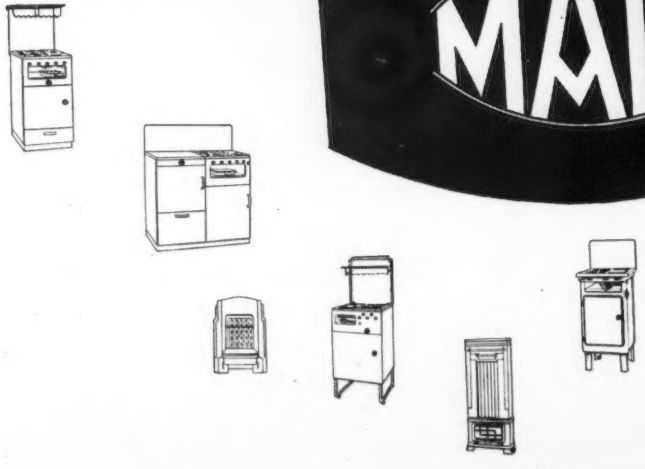
JB. 39

servingfa



La Corbiere, Jersey

MAIN

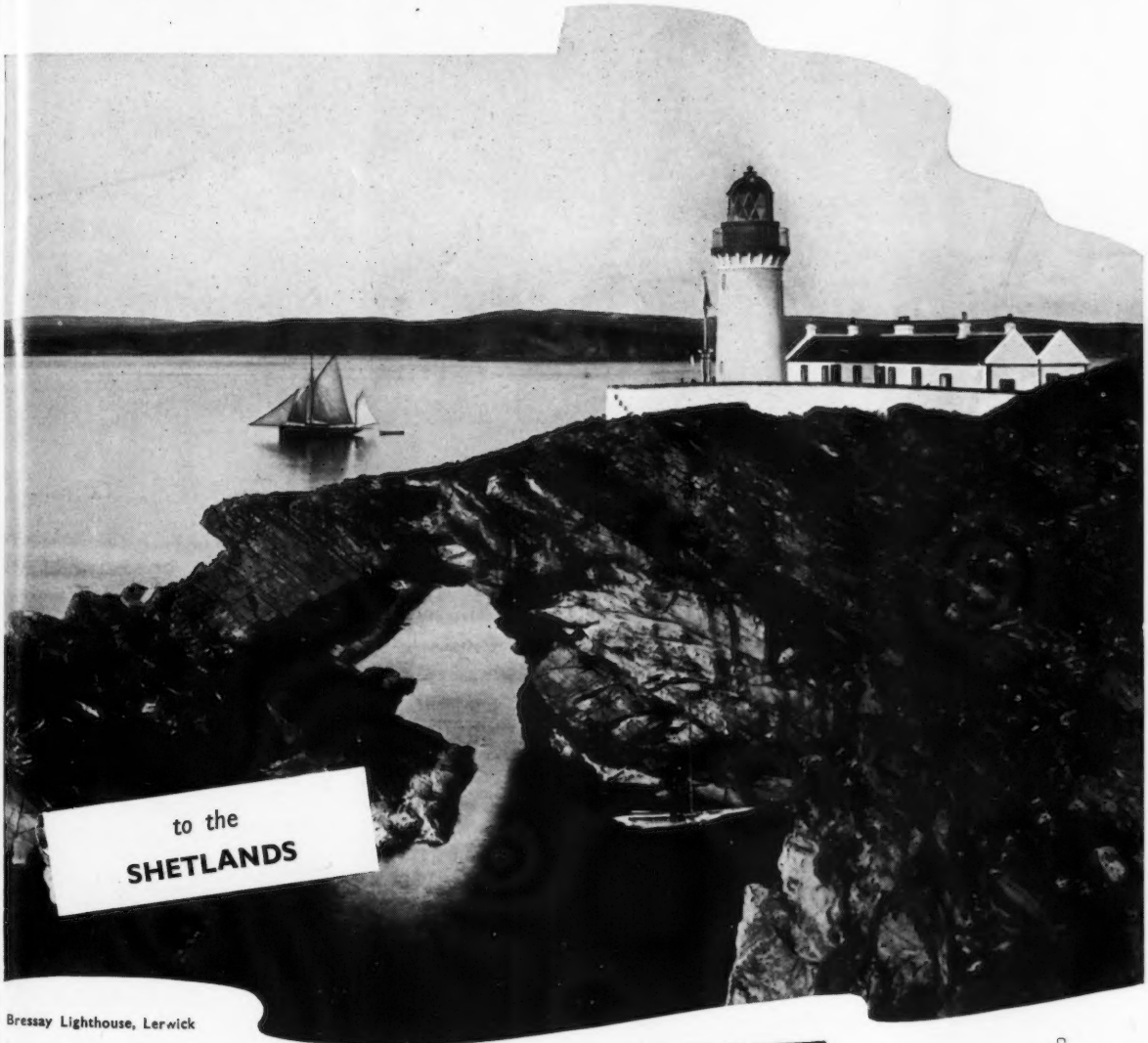


gasu

COC

F. &

...ingfar and wide

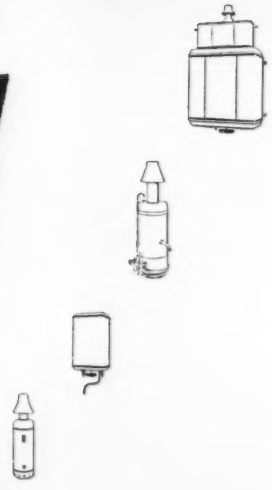


Bressay Lighthouse, Lerwick

...ere, Jersey

...asappliances

COOKERS · SPACE HEATERS · WATER HEATERS



F. & A. MAIN LTD · MAIN WATER HEATERS LTD.

CRAFTSMEN OF THE FUTURE

FOURTH GENERATION

Ivan Martin who joined us three years ago is an Apprentice Draughtsman and so maintains the family connection which has now lasted for four generations with this firm. Ivan is a keen footballer and cricketer and is opening batsman for a local village side. He is following the National Certificate Course in Engineering at Rotherham Technical College.

We, at Newton Chambers, have harnessed every modern method of training youth in good citizenship, and in technical skill which finds expression in the work of the younger generation of craftsmen making Thorncliffe engineering products, as it has with past generations for 160 years.

Thus, we are not entirely concerned with the production of tons of this or gallons of that, but we strive to ensure for customer, craftsman and Company a continuity of achievement in the fields of engineering, chemical technology, and Britain's competition for the world's business.

NEWTON CHAMBERS

& CO. LTD. THORNCLIFFE, Nr. SHEFFIELD

Gasholders · Purifiers · Condensing and Washing Plant · Tar Distillation Plants · Ammonia Liquor Concentration Plants · Sulphur Burners and General Heavy Engineering Products in Cast Iron and Mild Steel.

CARBON MONOXIDE*

By F. E. MILLS, B.Sc., M.Inst.Gas E., A.M.I.Chem.E.
and F. C. SMITH, F.C.S., M.Inst.Gas E.
North Thames Gas Board

MANY papers have been presented in the past from time to time on the precautions which are taken to ensure that gas may be made and used with as great a degree of safety as possible. The present paper is written primarily as a reminder that the safe use of gas is an aim and object which is ever before the gas industry, and in particular to bring to notice work which has been undertaken by our own board with this object in view.

To get the matter into proper perspective, it is usual to relate accidents involving the use of gas with those occurring from other sources. For instance, in the year 1947, fatal accidents occurred as follows:

	Accidental deaths in 1947 per mill. of population
Accidental deaths	349
Coal gas poisoning	9
Carbon monoxide	1
Transport, all forms	114
Burns	19
Suffocation	25
Drowning	27
Fall, crushing, &c.	103
From bed	2
Downstairs	14
Indoors	33
From ladder	2
In street	7
From window	3
Others	42

It is not often realised that more people lose their lives by falling downstairs or in the street than from coal gas poisoning.

Lessons to be Learnt

The comparative rareness of these accidents is not, however, regarded as a reason for complacency or a relaxation of vigilance. Each individual accident is made the subject of a special investigation, and any lessons which can be learnt therefrom are noted for use in the formulation of future precautions or policy.

For any given percentage of carbon monoxide in the inspired air there is a definite limit for the percentage of carbon monoxide-hæmoglobin that can be formed in the blood. The maximum percentage of carbon monoxide-hæmoglobin possible in the blood of a person breathing air containing 0·02% carbon monoxide is about 22·0% and this figure will not be exceeded no matter how long the subject is exposed to this concentration. We believe that the confusion which exists in the minds of some dealing with this problem can be explained by the fact that in the case of a subject exposed to a concentration above that which would prove fatal the percentage of carbon monoxide-hæmoglobin in the blood continues to increase with time until death occurs, and of course the maximum concentration of carbon monoxide-hæmoglobin corresponding to the percentage of carbon monoxide present may never be reached before the terminal event has occurred.

Percentage Saturation of the Blood with Carbon Monoxide and Corresponding Physiological Effects

These relationships are given in the standard books, but for the sake of completeness, the following are quoted:

Pathologists have attributed death to carbon monoxide at a saturation as low as 38% and in many cases death has occurred at saturations of the order of 50%.

In the case of children and elderly persons, relatively low saturations have been reported which have proved fatal, and these facts emphasise with what care the various criteria should be interpreted in all cases of physiological response. In certain cases the subject may have been exposed to relatively high percentages for a short time, then the source of carbon monoxide removed with a resultant lowering of the carbon monoxide-hæmoglobin saturation before the terminal event. In such cases, poor physical condition or reduced resistance may have prevented the improvement which should have resulted from the gradual substitution of pure air for that containing carbon monoxide.

Whatever may have been the reason, the fact remains that carbon monoxide was the primary cause of death.

Physiological Effects

It is apparent that it is a matter of considerable difficulty, even if the physiological effects of various blood saturations are known, to state how long an individual may be exposed to a concentration corresponding to a given blood saturation before experiencing the corresponding physiological symptoms. Henderson has proposed criteria, which, if properly applied with a recognition of their limitations, are of the greatest practical value in this connection.

TABLE 1

% of Haemoglobin in Combination with Carbon Monoxide	Physiological Effect
10	No appreciable effect, except shortness of breath on vigorous muscular exertion.
20	No appreciable effect in most cases except short wind even on moderate exertion; slight headache in some cases.
30	Decided headache; irritable; easily fatigued; judgment disturbed.
40–50	Headache, confusion, collapse and fainting on exertion.
60–70	Unconsciousness; respiratory failure and death if exposure is long continued.
80	Rapidly fatal
Over 80	Immediately fatal

Henderson's Criteria

The time in hours is multiplied by the percentage of carbon monoxide in the inhaled air to give an index figure which is indicative of the physiological effect of the exposure.

TABLE 2

Index Figure	Physiological Effect
0·03	No perceptible effect
0·06	A just appreciable effect
0·09	Headache and nausea
0·15	Dangerous to life

The index figures, if applied mathematically without regard to the fundamental fact that it is the percentage of carbon monoxide-hæmoglobin in the blood which determines the physiological response, can be most misleading, and thus lead to conclusions which are entirely erroneous. A simple illustration will illustrate this point.

* From a paper to the London and Southern Junior Gas Association, May 12, 1950.

Consider the index figure 0·15, which indicates a condition dangerous to life.

The value 0·15 could be obtained from a short exposure to high carbon monoxide concentration, or at the other extreme, a long exposure to low concentration. For instance, 100 hours exposure to a concentration of 0·0015% would mathematically give the index figure of 0·15, but the maximum blood saturation which could occur at equilibrium would be approximately 2%, and it may reasonably be assumed that an exposure for 100 hours would be sufficiently long, even if the subject were at rest throughout the period of exposure, for the blood to attain the saturation corresponding to this concentration.

If Table 1 be consulted it is evident that a 2% blood saturation would be without perceptible physiological symptoms. On the other hand an exposure to a concentration of 0·1% for a period of 1½ hours would give the index figure of 0·15.

A concentration of 0·1%, if inspired for a sufficient length of time to bring about equilibrium, would lead to a blood saturation of 59% which Table 3 indicates will cause unconsciousness, and death if the exposure is prolonged. The latter example is clearly a legitimate way of applying the criterion. Henderson and his co-workers were, of course, aware of this limitation. Table 3 has been included so that the various indications of physiological response may be grouped together in a convenient form, and the limitations of each appreciated.

TABLE 3

PART A			PART B		
% Concentration of CO in Inspired Air	Physiological Effect (After Henderson)	Calculated Blood Saturation % at Equilibrium	Blood Saturation %	Calculated % CO in Inspired Air	Physiological Effect (After Henderson)
0·01	Concentration allowable for several hours	13	10 20	0·008 0·017	No appreciable effect " " "
0·04 0·05	Can be inhaled for 1 hr. without appreciable effect.	36 42	30 40 50	0·03 0·045 0·07	Decided headache; judgement impaired. Headache, confusion, collapse and fainting on exertion
0·06 0·07	Just perceptible after 1 hr.	46 50			
0·10 0·12	Unpleasant, but not dangerous symptoms after 1 hr.	59 62			
0·15 0·20	Dangerous concentration for exposure for 1 hr.	68 74	60 70	0·105 0·162	Unconsciousness; respiratory failure and death if exposure is long continued.
0·4 and above	Concentrations which are fatal on exposure for less than 1 hr.	85	80 over 80	0·28	Rapidly fatal Immediately fatal

In comparing Parts A and B of Table 3 it will be apparent that Part B deals with the physiological symptoms which are experienced when the exposure has been of long enough duration to ensure that the blood has become saturated to the percentage associated at equilibrium with the concentration of carbon monoxide in the inspired air; whereas Part A gives details of the symptoms after exposure (except for that of 0·01) for relatively short periods:—*i.e.*, before the blood has reached the saturation associated with the carbon monoxide concentrations in the inspired air at equilibrium. Henderson's criteria, properly used, bridges Parts A and B.

It is again stressed that these are all for normal healthy people, and that even in this group considerable caution should be observed in applying the various indications as to probable physiological response.

Occurrence of Carbon Monoxide in Products of Combustion

This matter has been dealt with at some length by Masterman and Dunning. After discussing the theory of combustion these authors stated: 'Self supporting gaseous combustion can result in incomplete oxidation for two reasons only:—

1. Inadequate oxygen supplies in or immediately adjacent to the combustion zone.
2. Chilling out the reaction before it is complete.'

The authors also call attention to the effect of vitiated atmospheres on combustion standards.

The work of Masterman and Dunning and many others has been of the greatest value in aiding appliance design, and establishing the causes of unsatisfactory performance, and it is not therefore proposed to discuss further this aspect of the subject in this paper. The requirement for combustion performance as laid down in B.S.717 will be reviewed with the object of studying how far the safety margin provided is adequate to safeguard against adverse factors which may obtain under conditions of practical usage.

In the next section of this paper the importance of impaired combustion resulting from appliances operating in vitiated atmospheres is discussed and the precautions necessary to avoid these are considered. The present section deals only with appliances operating in normal atmospheres.

It is important to remember that the highest combustion standard possible for an appliance depends upon the type of appliance. Masterman and Dunning recognised three distinct types, which are as follows:—

(a) Appliances having free burning flames.
(b) Appliances which, by reason of restricted air inlet or flueways, limit the volume of excess air which passes through the combustion zone.
(c) Appliances the flames of which make contact with solid surfaces.

In general, appliances under (a) are capable of the highest combustion performance, with types (b) and (c) following in the order given.

Value of B.S. 717 Requirement

The B.S.717 requirement is that the CO/CO_2 for the flue gases for an ungoverned appliance, when adjusted to operate at the approved rating at normal pressure, shall not exceed 0·02 when the appliance so adjusted is subject to a pressure overload of 100%.

For governed appliances this requirement shall be satisfied at a pressure overload of 50%.

The CO/CO_2 does not of itself indicate whether an appliance is suitable for operation under a given set of conditions but is evidence as to the standard of combustion which may be relied upon from the appliance when new and operating under similar circumstances to those which obtained when tested in the laboratory. If the constitution of the gas is known, the CO_2 produced per cu. ft. on combustion can be calculated and hence the CO/CO_2 enables the volume of CO produced per hour to be computed.

The fact that the CO/CO_2 is determined at a pressure overload of 100% or 50%, depending upon whether the appliance has an integral governor, is a valuable safeguard as it ensures a margin of safety when the appliance is used under district conditions.

The following factors tend to affect combustion performance of appliances under practical district conditions.

Modern gas appliances made by makers of repute reach a high standard of precision; nevertheless manufacturing toler-

ances have to be accepted as in any other engineering production.

Small changes in dimensions of component parts and diversity during assembly, &c., may be of some moment in influencing the overall combustion performance, especially if the variations become additive in their effect. The laboratory sample on which the appliance is approved, although submitted in all good faith, may not represent the mean performance for all the appliances subsequently delivered.

It is for this reason that inspection is undertaken by the makers at works, and that certain boards also examine at least a percentage of bulk deliveries. It is easy to suggest that dimensions affecting combustion should be liberal enough to prevent any effect of accumulated tolerances prejudicing the attainment of the highest standard of combustion possible for the class of appliance concerned, but this, in the opinion of the authors, is an over simplification of the problem since efficiency is a matter of some moment, and the heat exchange problem involved may necessitate working to fairly fine dimensions. It is clear that the overload requirement of B.S.717 is of value in this connection, but in fairness it must be stated that manufacturing tolerances, except perhaps in tinsmiths' assemblies, for well designed appliances are probably of considerably less significance than other factors to be considered.

Apart from manufacturing tolerances affecting the dimensions and form of orifices, gasways, &c., departure from the approved thermal input for the appliance may occur for the following reasons.

(a) Changes in distributing pressures.
(b) Lack of precision adjustment by the fitter.
(c) Changes in the Wobbe No. of the gas distributed.
(d) Corrosion or blockage of injectors or burners.

The effect of the first two of the above factors is reduced to a minimum if fixed injectors or luminous burners are used in conjunction with a pressure governor. It is clear that the mechanical components affecting the thermal input can be checked with accuracy at the works, and that greater precision in B.Th.U. input is assured than would be the case if the fitter has to make adjustments on the consumers' premises. Volume governors for appliances for which they are suitable secure a similar advantage.

Advantage of Governor Use

The advantage gained by the use of governors is reflected in the easier requirement of B.S.717 in regard to the pressure overload to which appliances fitted with these devices have to be submitted.

When variable injectors are used these will have to be adjusted by the fitter on the premises, and even if the appliance is pressure governed some appreciable departures from the approved ratings for the appliance must be anticipated.

If the appliance or service is not governed, the gas rate will vary in response to the changing pressure conditions, and the fitter's task becomes more difficult since he must adjust in terms of the pressure prevailing at the time of the visit.

The thermal input, other conditions being constant, will vary directly with the Wobbe No., an increase in this number increasing the thermal input.

In the case of luminous burners, corrosion or blockage of injectors, &c., may reduce or increase the B.Th.U. input according to circumstances, but almost invariably some distortion in flame shape and orientation occurs and these conditions may adversely affect combustion either directly or indirectly. Similarly, changes in the orifice size of injectors and of flame ports affect the performance of aerated burners. These and associated factors must be considered in relation to combustion. The quality and frequency of maintenance is clearly of importance in relation to the above matters.

Changes in gas characteristics as indicated by the Aeration Test Burner are certainly not without effect upon the stability and combustion efficiency of aerated burners. The effect of distributing gas of high A.T.B. No. to appliances set to operate on gas of normal value is to reduce the ratio of the total flame height to cone height, and this generally leads to a higher CO/CO_2 than would otherwise be the case.

If low A.T.B. gas be supplied to burners adjusted for normal gas, the flame height-cone height ratio is increased, and instability may occur.

Under present conditions of plant shortage, delayed delivery of new plant, and for economic and other reasons changes in gas characteristics, especially at times of peak demand, must be expected and accepted. It is, therefore, essential that appliances having aerated burners, when adjusted for normal A.T.B. gas, shall be capable of operating over a prescribed range of A.T.B. numbers with flame stability and good combustion.

In the case of burners which have to be adjusted on the district the fitter has to make the necessary settings in terms of the gas supplied to the address at the time of the visit. If unaided by any device indicating the characteristics of the gas at the time he will adjust to obtain the required cone height which is applicable for normal gas. If the gas is of high A.T.B. No. at the time, the cone height will be too short when normal gas is distributed and there will be a tendency to instability. If the gas is of low A.T.B. No. then when normal gas is supplied the cone height will be too long, and in general, although not without exception, the CO/CO_2 will increase. The flame matching burner, introduced recently by the North Thames Gas Board, is of great assistance in reducing both these adverse effects to a minimum since it allows adjustments to be made on gas of any value within the prescribed range for which the flame matching burner is calibrated, and this ensures that the cone height for appliances so adjusted will be correct when normal gas is distributed.

In passing, it should be stated that the usual procedure at Watson House is to examine the appliance for flame stability when operated on gas of the lowest A.T.B. No. likely to be experienced in practice, and to determine the CO/CO_2 at the approved rate when operating on gas of the highest A.T.B. No. on which the appliance may have to function. The possible effect of changes of benzole content on appliances with luminous burners is also considered during tests.

Appliances tested for approval in the laboratories are new, clean, and well adjusted, but in practice, after heavy usage for prolonged periods, conditions may arise which are prejudicial to the highest combustion standards. The value of effective maintenance cannot be too highly stressed.

Life tests of appliances under accelerated conditions in the laboratory are of the utmost value in disclosing weaknesses in design or giving information in regard to the choice of the most satisfactory materials or protection against corrosion, and it is common to measure the CO/CO_2 after various periods of operation in order to see how far adverse conditions may impair combustion efficiency.

Such tests together with district experience give valuable information in regard to suitable maintenance schedules to ensure good service in practice.

Effect of Vitiated Atmospheres

In this section the various factors which can adversely affect combustion have been considered in some detail, and the wisdom of carrying out combustion tests at overload in order to provide an adequate margin of safety appears to the authors to be beyond question. We believe the margin of safety provided by the B.S. requirements are adequate, always assuming attention is given to reasonable ventilation and the other factors referred to elsewhere in this paper. Experience confirms this view.

In the foregoing section we have discussed carbon monoxide in the products from gas appliances burning in fresh air, both under laboratory conditions and on the district. Since, however, any combustion presupposes a proper supply of oxygen, it may be expected that a deficiency of oxygen will ultimately result in incomplete combustion. It becomes necessary, therefore, to consider the possibility of gas appliances operating in circumstances where the atmosphere may become vitiated, and for the present purpose the only circumstances which will be

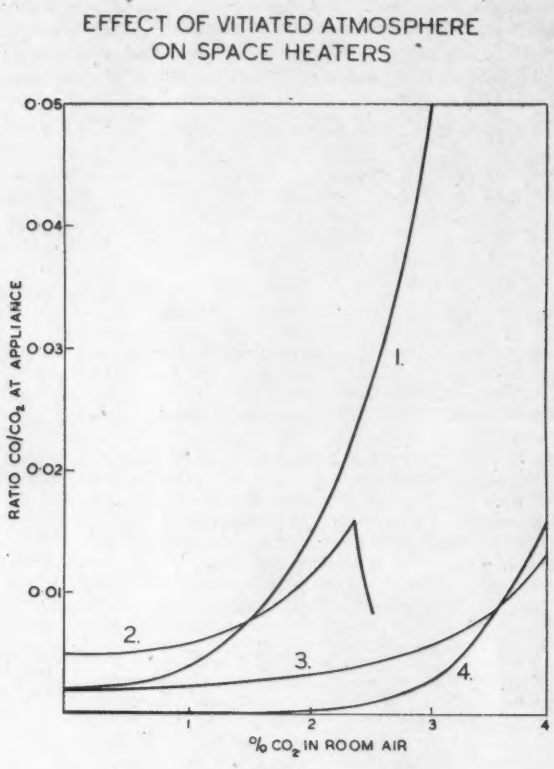


Fig. 1

considered are those in which the products of combustion from the appliance enter the room where the appliance is burning. If the additional effect of the presence of human beings in the room is to be considered, each person may be regarded as being equivalent to an additional gas rate of one or two cu. ft. per hour.

The effects of vitiated air on combustion have been summarised by Masterman *et al.*, who state that the first effect is an increase in the overall size of the flame, as though it were reaching out for sufficient oxygen. At the same time, the inner cone of an aerated flame lengthens as vitiation proceeds until it ultimately disappears, while the flame becomes progressively more flabby.

Provided there is no flame contact, combustion may be complete up to the point when it ceases altogether, even though the oxygen concentration is then far from sufficient to support the combustion of candles, matches, &c. Thus appliances having free-burning flames—*e.g.*, drying cabinets and some flueless space heaters—are generally immune to vitiation up to the point where the atmosphere would not be tolerated for physiological reasons.

In the case of appliances which, although having free-burning flames, have restricted air inlets or flueways, the degree to which they can be overloaded is lessened by vitiation. Instantaneous water heaters are typical of this class, and they are designed to have a safety margin which is usually sufficiently large to permit of some degree of vitiation. The margin is, however, reduced by vitiation and steps must always be taken to ensure that it is not reduced to the point of danger.

Appliances in which the flames make contact with solid surfaces, whether these be hot or cold, as would be anticipated are more susceptible to the effects of vitiated air. In general, the production of carbon monoxide is not delayed until some critical limit is reached, as with free-burning flames, but increases steadily with increasing vitiation of the air until relatively large volumes of carbon monoxide are being produced without extinction of the flame.

The particular case of flueless space heaters has received consideration in recent years, because the products from these are discharged into the room, and if the amount of them is great enough and the air change through the room small enough some vitiation will occur.

Many different types of these heaters have been examined by leaving them alight in a room so designed that the air change could be controlled. Samples of the air in the room and of the products from the appliance were withdrawn for analysis periodically, and the progress of the build-up of carbon dioxide in the room was compared with the CO/CO_2 in the products. This ratio was derived by means of the expression:

$$\frac{CO_F - CO_A}{CO_{2F} - CO_{2A}}$$

where F refers to the flue gas and A to the air of the room.

Fig. 1 illustrates the results obtained from four heaters of different types which are typical of the four classes into which they fall. Curve 1 is for the orthodox type of radiant heater with an aerated burner and clay radiants. Such appliances are the most susceptible to vitiation. Curve 2 is for a heater fitted with a horizontal steel radiant heated by an aerated burner. In this type the CO/CO_2 increases a little as vitiation proceeds and later diminishes again, probably as the flames pass through the radiant and burn on the top as free-burning flames. Curve 3 is for a heater using a neat flame enclosed in a vertical metal radiant, while Curve 4 is for a heater using an orthodox clay radiant fitting against a refractory brick but using neat flames. In the last two types vitiation has to be very severe before the CO/CO_2 is affected.

It is quite evident that the production of carbon monoxide from these appliances is associated with flame contact, and further experiments have substantiated this. In Fig. 2, Curve 1 was obtained from a heater of Class 1, properly adjusted with a $\frac{1}{8}$ in. cone height. In Curves 2, 3, and 4 the cone height

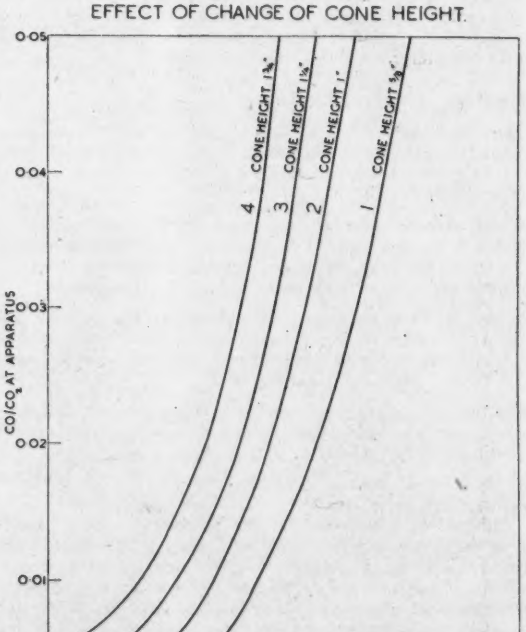


Fig. 2

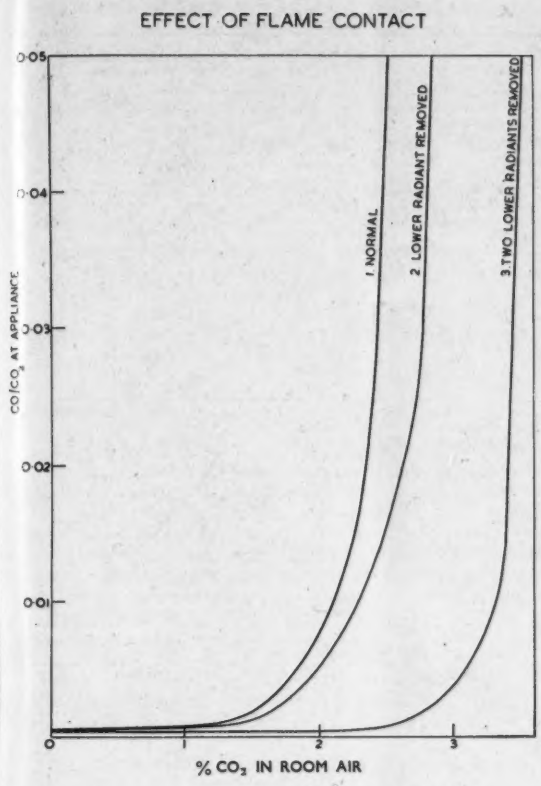


Fig. 3

was successively increased to 1 in., 1½ in., and 1¾ in. respectively, in each case without altering the gas rate.

Flame contact by non-aerated flames in gas fires has similar effects, as is shown in Fig. 3. Curve 1 shows the effec of vitiation on a fire with non-aerated flames and horizontal radiants, while Curves 2 and 3 show the same fire burning at the same gas rate with, respectively, one and two of the lower radiants removed.

Precautions Against Air Vitiation

The factors determining the degree of air vitiation are as follows:—

(a) The rate at which gas is consumed considered in relation to the volume of the room, and the air change per hour.
(b) The volume of products discharged into the room per hour considered in relation to the size of the room, and the air change per hour.
(c) Whether the discharge of products into the room is continuous or intermittent and the periods over which each condition may persist.
(d) The performance of the appliance in vitiated atmosphere (See Figs. 1, 2, and 3).

In all which follows it has been assumed that the combustion standard for the appliance operated in normal air conforms to the requirements of B.S.717. The B.S.I. requirement for combustion, as at present stated, makes no reference to a performance requirement when the appliance is operated in a vitiated atmosphere. The North Thames Gas Board requirement for a flueless heater is that the CO/CO_2 shall not exceed 0·02 when the appliance is operated at normal gas rate in an atmosphere containing up to 2% CO_2 with the corresponding reduction in the O_2 content of the air. It cannot be too clearly stated that the board's requirement for vitiated atmospheres is not made so that flueless heaters can be used in ill-ventilated rooms but rather as a safeguard against vitiation should this occur inadvertently.

In Figs. 4 and 5 are plotted the value of Henderson's Criterion against time for various conditions, and lines are drawn for values of the criterion of 0·03, 0·06 and 0·09. The physiological significance of these values has been referred to previously.

Figs. 1, 2, 3 indicate how the CO/CO_2 increases with air vitiation for typical classes of flueless heaters, and also emphasise the importance of good maintenance and satisfactory adjustment. For the appliances referred to on the graphs it is possible to read off the percentage of CO_2 (the index to vitiation) which is critical for the appliance concerned; and from Table 3 to determine the minimum air change for a given gas rate per 100 cu. ft. room capacity to avoid the establishing of this critical percentage of CO_2 in the room air.

Installation Conditions

The authors are of the opinion that when flueless appliances are installed the conditions should be such that the value of Henderson's Criterion should not greatly exceed 0·03, as this value indicates that the CO present will be without any physiological effect whatever upon the occupants. For example, a minimum air change of 2 per hour is necessary for a room in which an appliance having a CO/CO_2 of 0·02 and with a gas rate of 1 cu. ft./hr./100 cu. ft. of room space is operating continuously if the conditions are to satisfy the standard requirement suggested by the authors.

Again if the CO/CO_2 does not, under conditions of good maintenance, exceed 0·01 at any time, one air change would be adequate for a gas rate of 1 cu. ft./hr./100 cu. ft. of room space.

It is pertinent at this stage to refer to the guidance given by the North Thames Gas Board to district personnel when arranging for the installation of flueless heaters.

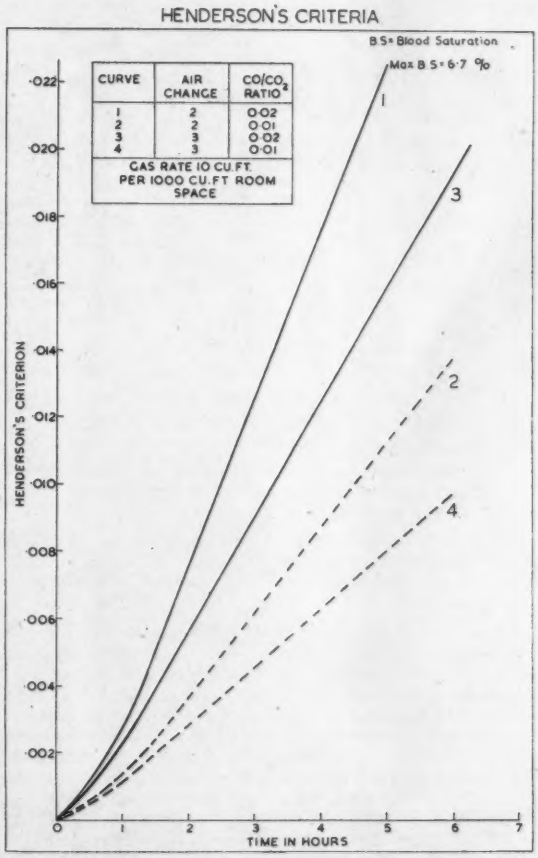


Fig. 4

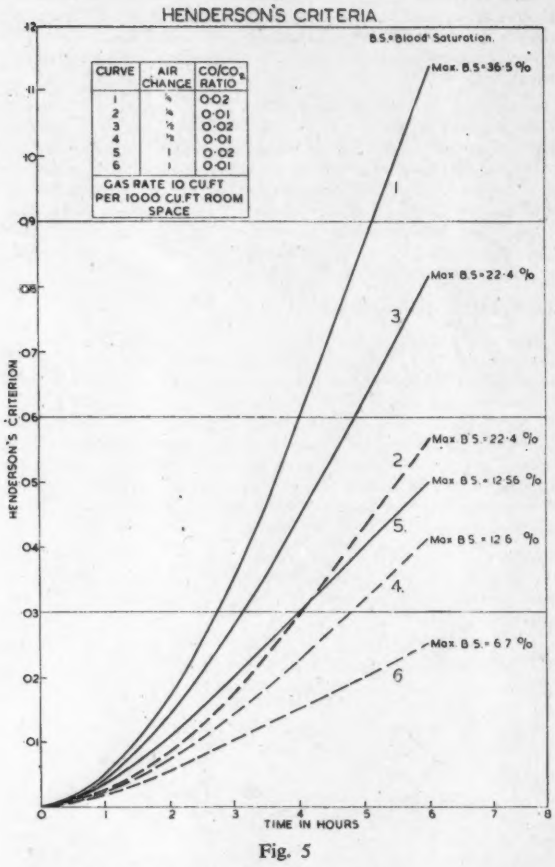

HENDERSON'S CRITERIA
B.S.=Blood Saturation.
CURVE | AIR CHANGE | CO/CO2 RATIO
1 | ½ | 0·02
2 | ½ | 0·01
3 | ½ | 0·02
4 | ½ | 0·01
5 | 1 | 0·02
6 | 1 | 0·01
GAS RATE 10 CU.FT PER 1000 CU.FT ROOM SPACE
Max. B.S.=36·5 %
Max B.S.=22·4 %
Max B.S.=22·4 %
Max B.S.=12·56 %
Max B.S.=12·6 %
Max B.S.=6·7 %
HENDERSON'S CRITERION
TIME IN HOURS

Fig. 5

Flueless heaters are most suitable for:—

1. Places, not in continuous occupation, where a reasonable warmth is desirable and which makes a contribution to the general comfort of the house. Halls and passages are a good example of this use.
2. Room heating under mild weather conditions where the temperature rise required to secure comfort is small.
3. Partial heating of rooms in which the principal heating is by a gas fire or other agent such as solid fuel, &c.

It is recognised that the most exacting conditions arise when flueless appliances are used as the only heating agent.

The requirements are:—

1. The heater must be an approved appliance.
2. The gas rate must be related to the room size.
3. The room ventilation must be adequate.

The first two requirements are readily met, but the assessment of the probable air change, influenced as it is by a number of factors some of which change from time to time, is not quite so simple.

In this connection the term 'Permanent Ventilation' is applied to the air change which will occur when the windows are closed and is not to be confused with 'Occasional Ventilation,' which is dependent upon doors and windows being open, a condition which should not be relied upon as a means of contributing to the ventilation required for the successful use of flueless heaters.

Ventilation Requirements

In no circumstances must a heater be fitted in a room which has neither an air brick nor a flue.

The following tables summarise the minimum requirements of room sizes, ventilation and gas rates for flueless heaters.

A. Rooms with air brick to outside air but no flue.

Type of Room	Minimum size of air brick	Maximum gas rate permissible
Not of abnormally tight construction	10 sq. in. free area	5 cu. ft./hr./1,000 cu. ft. of room space
	20 sq. in. free area	10 cu. ft./hr./1,000 cu. ft. of room space
Tight construction (*i.e.*, ferro-concrete with painted walls, &c.)	20 sq. in. free area	5 cu. ft./hr./1,000 cu. ft. of room sp

B. Rooms with air brick to an internal landing or corridor but with no flue.

Type of Room	Minimum size of air brick	Maximum gas rate permissible
Not of abnormally tight construction	20 sq. in. free area	5 cu. ft./hr./1,000 cu. ft. of room space
,,	40 sq. in. free area	10 cu. ft./hr./1,000 cu. ft. of room space
Tight construction	40 sq. in. free area	5 cu. ft./hr./1,000 cu. ft. of room space

C. Rooms with a normal flue.

Type of Room	Minimum flue size	Maximum gas rate permissible
Any type	20 sq. in. free area	10 cu. ft./hr./1,000 fu. ft. of room space

Experience has shown that if these instructions are followed the results are satisfactory in practice from all points of view.

Flued Appliances and Vitiated Atmospheres

All flued appliances, other than those operating on the balanced flue principle, will probably, under certain conditions of wind direction and velocity, and flue termination, experience down-blow at certain times during their operation. The provision of draught interrupters is a recognition of this fact and a safety precaution against adverse conditions affecting directly the standard of combustion performance. Under conditions of down-blow, therefore, products of combustion will enter the room and bring about a measure of air vitiation which can, under bad conditions, prejudice combustion.

It is difficult to obtain a satisfactory theoretical approach and practical solution of this problem because:—

(a) the percentage of the total products of combustion entering the room varies with wind velocity and direction, which often vary from moment to moment, and,
(b) down-blow may be, and often is, intermittent and it is impossible to predict the relative period of time over which each condition will obtain.

A great deal can be done to minimise down-blow by a choice of suitable terminals and by choosing the position for termination in relation to the direction of the prevailing wind, the structural features of the building concerned, and the surrounding property. Even so, down-blow conditions may be expected to occur at intervals.

Gas Appliances in Bathrooms

A study of this problem has been made by the North Thames Gas Board and notes have been issued for the guidance of the district staff. It may be helpful to review the problem, and to summarise the recommendations.

A survey before the war indicated that 66% of the bathrooms in low income group houses had a cubic capacity of 350 cu. ft. or less. Many bathrooms in modern houses have capacities of the order of 250-300 cu. ft., and some of even less than 250 cu. ft.

An instantaneous water heater fitted in such bathrooms and flued to the outside air may have a gas rate of from 150-180 cu. ft. per hour, and adequate ventilation is essential for a

number of reasons. Some water heaters still have engraved on the heater, or printed on the instruction card, such directions as 'Open the window when the water heater is in use. Do not enter the bath while the heater is alight.' While this may be sound advice, the well-being of the user should not be dependent upon the observance of any such directives.

The atmosphere in a bathroom is of necessity humid and steamy, and adequate air change is a necessity to minimise these inconveniences. Permanent and adequate ventilation without unwanted draughts must therefore be provided to ensure acceptable conditions.

Fundamental considerations are as follows:—

1. The combustion characteristics of the appliance must satisfy the requirements of B.S.717.
2. The appliance must be set to operate at a rating as near as is possible under practical conditions to the approved rates for the appliance.
3. The maintenance must be such as to ensure satisfactory combustion and efficient service.
4. Adequate air change, which is not dependent upon doors and windows being opened, is essential.

Approved appliances when fitted correctly and operated at the approved rate under conditions which permit of an adequate supply of air to the combustion zone may be relied upon to ensure complete combustion. Under these conditions, given reasonable maintenance, the problem resolves itself into ensuring the required air change through the room.

Air Requirements

One cubic foot of gas of C.V. 500 requires approximately 4½ cu. ft. of air delivered to the combustion zone for complete combustion. Moreover, additional air to that required for combustion is admitted to the heater in order to avoid unwanted condensation, &c. In general something of the order of 7½ cu. ft. of air is wanted at the burner of the water heater for each foot of gas consumed.

Assume for instance that a bathroom has a cubic capacity of 350 cu. ft. and a water heater of the instantaneous type of approved rating of 150 cu. ft./hr. flued to the outside air is fitted. The air requirements for the water heater will then be $7\frac{1}{2} \times 150 = 1{,}125$ cu. ft./hr.

Air must be admitted to the bathroom during the period the water heater is in operation at a rate of 1,125 cu. ft./hr., and on this account alone an air change of 1,125/350 (say 3 per hour) is necessary.

Effect of Down-blow

Under adverse wind conditions, products of combustion will be discharged, if only intermittently, from the draught diverter into the bathroom, and the air change must therefore be sufficient during the period of operation of the heater to prevent air vitiation reaching a degree which is seriously detrimental to combustion.

It is impossible to calculate the degree of vitiation which may occur, but the following table gives an indication of the order of this effect for presumed proportional periods of down-blow. It has also been assumed that during the period of down-blow all the products enter the bathroom (a condition which seldom obtains in practice), and that the period of operation of the heater to obtain a bath is 15 min.

The calculations are for a bathroom of 350 cu. ft. capacity, and the rated consumption for the heater is 150 cu. ft./hr. An air change of 3 per hour is assumed.

TABLE 4

% of time during period heater is in operation over which down-blow occurs	CO_2% present in air of bathroom after 15 min.
5	0·16
10	0·37
15	0·58
20	0·78
25	0·98
30	1·18
40	1·58
50	1·99

People are seldom in the bathroom for 15 min. with the door and window closed while the bath is in preparation, but these conditions do obtain on occasion in practice, and the above figures suggest the necessity of providing for reasonable air change in order to ensure good conditions under adverse circumstances.

The following notes indicate the approximate air change to be anticipated in bathrooms having the listed ventilation facilities. It should be noticed that the positive openings referred to do not include the fluepipe of the appliance. Windows and doors are not considered as positive ventilators.

Standard A.

No air bricks or other form of positive ventilation. Air enters and leaves through chance openings due to poorly fitting windows or doors and through porous walls. Probable air change about ½ per hour.

Standard B.

With one positive opening of not less than 5 sq. in. free area. A 9 in. × 3 in. air brick usually has a free opening of not less than 5 sq. in., but this should be checked on the premises. In addition, chance openings as in standard A. Probable air change about 1 per hour.

Standard C.

With one positive opening of not less than 15 sq. in. free area. A 9 in. × 9 in. air brick usually has a free opening of 15 sq. in., but, as before, this requires checking on the premises. In addition, chance openings as in standards A and B. Probable air change about 1½ per hour.

Standard D.

With one opposite opening of not less than 15 sq. in. free area, preferably at or near ceiling level, and an additional opening of equivalent area preferably on an opposing wall and at a different level. The Gas Light & Coke Company's approved ventilating door plate will serve as the additional opening to convert standard C to standard D ventilation. Probable air change about 3 per hour.

The following table shows the appliances which, when fitted in bathrooms with different standards of ventilation, will conform with the general principles stated in this paper. This table is included in the notes for guidance issued by the North Thames Gas Board to the district staff.

TABLE 5

Standard of ventilation	Water heating appliance permitted	Additional flueless gas rate allowable per hr./100 cu. ft. of air space
A	None	½
B	Flued and governed wash boiler	None
	Flueless sink storage heater	1
	Flueless instantaneous sink heater*	1
C	Flued and governed wash boiler	1
	Flueless sink storage heater	1½
	Flueless instantaneous sink heater*	1
	Flued storage water heater, 25 cu. ft./hr.	1
	Flued instantaneous bath water heater (gas rate not to exceed 0·6 times volume of bathroom)	None
D	Flued wash boiler	1½
	Flueless sink storage heater	2
	Flueless instantaneous sink heater*	2
	Flued storage water heater, 25 cu. ft. /hr.	2
	Flued instantaneous bath water heater (gas rate not to exceed 0·6 times volume of bathroom)	2

*For supplying wash basin only.

In modern building schemes, although the kitchens in flats and many houses are quite small, amenities are required for cooking, washing, drying, &c., and in consequence appliances for these services have often to be provided in these relatively small rooms. Adequate ventilation is essential in order to avoid over-heating and to minimise condensation on the walls, &c. which, in the main, is due to the evolution of water vapour and steam from the cooking, washing, and drying processes.

The paper is not primarily concerned with these aspects, but it is concerned with the possibility of low air change establishing conditions at high gas rates which are prejudicial to satisfactory

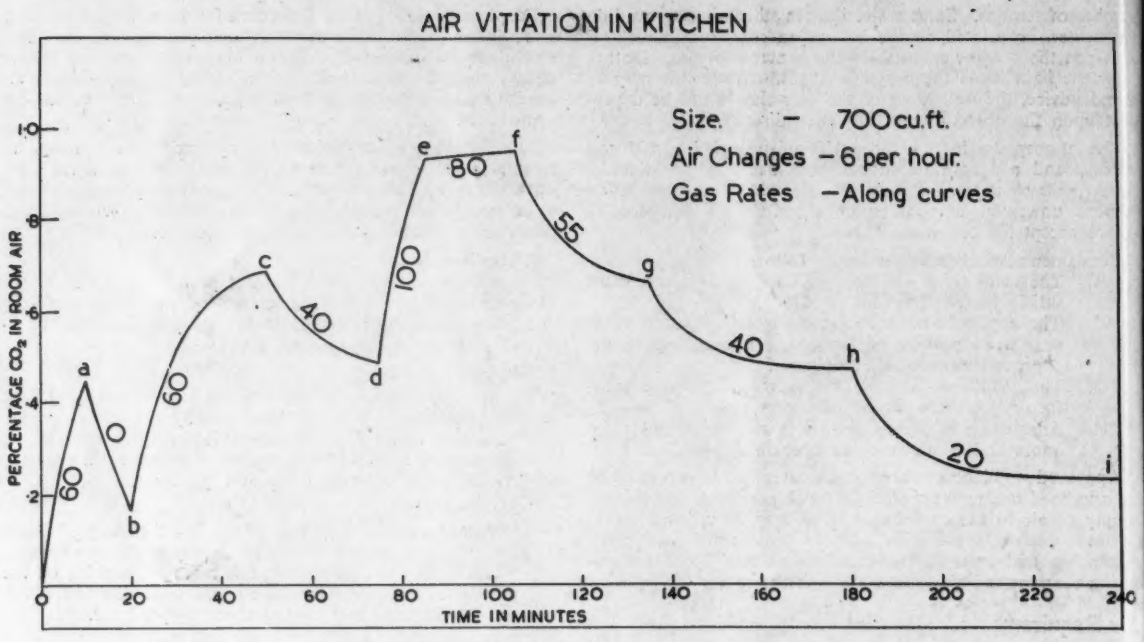


Fig. 6

combustion. This problem in regard to kitchens differs in many ways from those for bathrooms and living rooms.

(a) Kitchens are seldom isolated from the rest of the house or flat for lengthy periods, since the housewife, when cooking or washing, is continually passing in and out of the kitchen. The opening of doors even for a short period rapidly changes the air. Moreover, the housewife will usually increase the ventilation by opening a window if the atmosphere becomes oppressive.

(b) Although some of the appliances normally fitted in kitchens are virtually flueless heaters, the coincidence and length of use of the various appliances must be considered when assessing the possible build up of carbon dioxide in the kitchen air.

(c) Even if two or more appliances are in use together for a limited time the total gas rate will seldom equal the sum of the maximum rates for each of the appliances.

(d) Several typical cycles of operation have been considered by D. R. Wills, and curves which relate the build up and fall in the carbon dioxide in the air with time under various usages have been calculated and plotted by him. Fig. 6 is one such curve, and was calculated for the following cycle of operations.

		Gas Rate cu. ft./hr.
o – a	Water heater on for 10 min.	60
a – b	Washing of light articles	nil
b – c	Drying cabinet on. Water in copper heated for next wash	60
c – d	Washing for 25 min. Copper turned off, cooker on	40
d – e	Refill of hot water, water heater on ...	100
e – f	Water heater off, copper on for boiling of heavy wash	80
f – g	Copper turned down to 15 cu. ft./hr. ...	55
g – h	Copper turned off	40
h – i	Cooker turned off	20

Curves such as that of Fig. 6 can be calculated for any desired series of operations by means of the following formula:

$$P = \frac{100RC}{VN} - e^{-NT}\left(\frac{100RC}{VN} - P_o\right)$$

where P is the initial percentage concentration of CO_2

P „ „ final „ „ „ „
R „ „ gas rate in cu. ft./hr.
C „ „ volume of CO_2 produced per cu. ft. of
V „ „ „ „ the room in cu. ft.
N „ „ number of air changes per hour.
T „ „ time in hours between P_o and P.

Having regard to the general combustion performance of appliances likely to be used in the kitchen, it appears a reasonable rule for guidance to arrange for permanent ventilation which will ensure, under all normal conditions of usage of kitchen appliances installed, that the carbon dioxide content of the air shall not greatly exceed 1%. This in general does not impose conditions any more onerous than those required to satisfy comfort conditions in such rooms.

Local authorities are in general willing to arrange for permanent ventilation of the order required and appreciate that reduction in condensation is a great advantage in so far as it reduces the cost of maintenance and decorations, &c.

The use of ventilators which automatically reduce the free area at high wind velocities is a great advantage in avoiding unwanted draughts when abnormal conditions occur.

Ventilation

This paper has throughout stressed the importance of adequate ventilation and it may be thought that the conditions advocated are necessitated by safety considerations which arise solely from the use of gas as a fuel. It will be well, therefore, as a corrective, to refer to Chapter IC Ventilation from the Code of Functional Requirements of Buildings issued by the British Standards Institution for the Council of Codes of Practice for Buildings.

This chapter sets out at length the reasons why air change and air movement are necessary in the interests of health and general well being, and these reasons are entirely independent of the fuel used whether this be solid fuel, gas, or electricity. The authors recommend those interested in this subject to study the findings of this thoroughly representative committee.

Printed in England by STAPLES PRESS LTD., at their Bayswater, London, establishment for Walter King, Limited, 11, Bolt Court, London, E.C.4.